VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

3rd to 8th Semester BE –

Artificial Intelligence and Machine Learning (AI)

Scheme of Teaching and Examinations

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2018 – 19)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

Artificial Intelligence and Machine Learning (AI)

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(Effective from the academic year 2018 – 19)

V SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	HSMC	18CS51	Management and Entrepreneurshipfor IT Industry	HSMC	2	2	--	03	40	60	100	3
2	PCC	18AI52	Python Programming	CS / IS / AI	3	2	--	03	40	60	100	4
3	PCC	18CS53	Database Management System	CS / IS / AI	3	2	--	03	40	60	100	4
4	PCC	18CS54	Automata Theory and Computability	CS / IS / AI	3	--	--	03	40	60	100	3
5	PCC	18AI55	Principles of Artificial Intelligence	CS / IS / AI	3	--	--	03	40	60	100	3
6	PCC	18AI56	Mathematics for Machine Learning	CS / IS / AI	3	--	--	03	40	60	100	3
7	PCC	18AIL57	Artificial Intelligence Laboratory	CS / IS / AI	--	2	2	03	40	60	100	2
8	PCC	18CSL58	DBMS Laboratory with mini project	CS / IS / AI	--	2	2	03	40	60	100	2
9	HSMC	18CIV59	Environmental Studies	Civil/ Environmental [Paper setting: Civil Engineering Board]	1	--	--	02	40	60	100	1
				TOTAL	**18**	**10**	**4**	**26**	**360**	**540**	**900**	**25**

Note: PCC: Professional Core, HSMC: Humanity and Social Science.

AICTE activity Points: In case students fail to earn the prescribed activity Points, eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

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VI SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	18AI61	Machine Learning	CS / IS / AI	3	2	--	03	40	60	100	4
2	PCC	18AI62	Digital Image Processing	CS / IS / AI	3	2	--	03	40	60	100	4
3	PCC	18AI63	Java for Mobile Applications	CS / IS / AI	3	2	--	03	40	60	100	4
4	PEC	18AI64X	Professional Elective -1	CS / IS / AI	3	--	--	03	40	60	100	3
5	OEC	18AI65X	Open Elective –A	CS / IS / AI	3	--	--	03	40	60	100	3
6	PCC	18AIL66	Machine Learning Laboratory	CS / IS / AI	--	2	2	03	40	60	100	2
7	PCC	18AIL67	Digital Image Processing Laboratory with mini project	CS / IS / Ai	--	2	2	03	40	60	100	2
8	MP	18AIL68	Mobile Application Development Laboratory	CS / IS / AI	--	2	2	03	40	60	100	2
9	INT	--	Internship	(To be carried out during the intervening vacations of VI and VII semesters)				--	--	--	--	--
				TOTAL	**15**	**12**	**6**	**24**	**320**	**480**	**800**	**24**

Note: PCC: Professional core, PEC: Professional Elective, OE: Open Elective, MP: Mini-project, INT: Internship.

Professional Elective -1

Course code under18XX64X	Course Title
18AI641	Natural Language Processing
18AI642	Software Project and Management
18AI643	Web Programming
18AI644	Foundation forData Science

Open Elective –A (18CS65x are not to be opted by CSE / ISE /AIML Programs)

18CS651	Mobile Application Development
18CS652	Introduction to Data Structures and Algorithms
18CS653	Programming in JAVA
18CS654	Introduction to Operating System

Students can select any one of the open electives offered by any Department (Please refer to the list of open electives under 18CS65X).
Selection of an open elective is not allowed provided,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Adviser/Mentor.

Mini-project work: Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the Mini-project work, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all the guides of the college. The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

SEE for Mini project:

(i) Single discipline: Contribution to the Mini-project and the performance of each group member shall be assessed individually in the semester end examination (SEE) conducted at the department.

(ii) Interdisciplinary: Contribution to the Mini-project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belong to.

Internship: All the students admitted to III year of BE/B.Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not takeup/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

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Artificial Intelligence and Machine Learning (AI)

Scheme of Teaching and Examinations
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
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VII SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	18AI71	Advanced Artificial Intelligence	CS / IS / AI	4	--	--	03	40	60	100	4
2	PCC	18AI72	Advanced Machine Learning	CS / IS / AI	4	--	--	03	40	60	100	4
3	PEC	18AI73X	Professional Elective – 2	CS / IS / AI	3	--	--	03	40	60	100	3
4	PEC	18AI74X	Professional Elective – 3	CS / IS / AI	3	--	--	03	40	60	100	3
5	OEC	18AI75X	Open Elective –B	CS / IS / AI	3	--	--	03	40	60	100	3
6	PCC	18AIL76	AI and ML Application Development Laboratory	CS / IS / AI	--	--	2	03	40	60	100	1
7	Project	18AIP77	Project Work Phase – 1	CS / IS / AI	--	--	2	--	100	--	100	2
8	INT	--	Internship	(If not completed during the vacation of VI and VII semesters, it has to be carried out during the intervening vacations of VII and VIII semesters								
				TOTAL	**17**	--	**4**	**18**	**340**	**360**	**700**	**20**

Note: PCC: Professional core, PEC: Professional Elective, OEC: Open Elective, INT: Internship.

Professional Elective – 2

Course code under 18CS73X	Course Title		
18AI731	Internet of Things	18AI733	Blockchain Technology
18AI732	Multiagent Systems	18AI734	Cloud Computing and Virtualization

Professional Electives – 3

Course code under 18CS74X	Course Title		
18AI741	Fuzzy Logic& its Applications	18AI743	Semantic Web and Social Network
18AI742	Computer Vision	18AI744	Business Intelligence

Open Elective –B (18CS75x are not to be opted by CSE / ISE / AIML Programs)

18CS751	Introduction to Big Data Analytics
18CS752	Python Application Programming
18CS753	Introduction to Artificial Intelligence
18CS754	Introduction to Dot Net framework for Application Development

Students can select any one of the open electives offered by any Department (Please refer to the list of open electives under 18CS75X).
Selection of an open elective is not allowed provided,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.
- Registration to electives shall be documented under the guidance of Programme Coordinator/ Adviser/Mentor.

Project work: Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary project can be assigned to an individual student or to a group having not more than 4 students. In extraordinary cases, like the funded projects requiring students from different disciplines, the project student strength can be 5 or 6.

CIE procedure for Project Work Phase - 1:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work phase -1, shall be based on the evaluation of the project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the Project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work phase -1, shall be based on the evaluation of project work phase -1 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

Internship: All the students admitted to III year of BE/B.Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not takeup/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

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VIII SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week: Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	PCC	18AI81	Neural Networks and Deep Learning	AM	3	--	--	03	40	60	100	3
2	PEC	18AI82X	Professional Elective – 4	AM	3	--	--	03	40	60	100	3
3	Project	18AIP83	Project Work Phase – 2	AM	--	--	2	03	40	60	100	8
4	Seminar	18AIS84	Technical Seminar	AM	--	--	2	03	100	--	100	1
5	INT	18AII85	Internship	(Completed during the intervening vacations of VI and VII semesters and /or VII and VIII semesters.)				03	40	60	100	3
				TOTAL	**06**	--	**4**	**15**	**260**	**240**	**500**	**18**

Note: PCC: Professional Core, PEC: Professional Elective, OEC: Open Elective, INT: Internship.

Professional Electives – 4

Course code under 18CS82X	Course Title
18AI821	System Modelling and Simulation
18AI822	Soft and Evolutionary Computing
18AI823	Robotic Process Automation Design and Development
18AI824	Modern Information Retrieval

Project Work CIE procedure for Project Work Phase - 2:
(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.
(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.
SEE for Project Work Phase - 2:
(i) Single discipline: Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted at the department.
(ii) Interdisciplinary: Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belong to.
Internship: Those, who have not pursued /completed the internship shall be declared as fail and have to complete during subsequent University examination after satisfying the internship requirements

AICTE activity Points: In case students fail to earn the prescribed activity Points, eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card. Activity points of the students who have earned the prescribed AICTE activity Points shall be sent the University along with the CIE marks of 8th semester. In case of students who have not satisfied the AICTE activity Points at the end of eighth semester, the column under activity Points shall be marked NSAP (Not Satisfied Activity Points).

<table>
<tr><td colspan="4" align="center">MANAGEMENT AND ENTREPRENEURSHIP FOR IT INDUSTRY
(Effective from the academic year 2018 -2019)
SEMESTER – V</td></tr>
<tr><td>Subject Code</td><td>18CS51</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Contact Hours/Week</td><td>2:2:0</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Contact Hours</td><td>40</td><td>Exam Hours</td><td>3 Hrs</td></tr>
<tr><td colspan="4" align="center">CREDITS – 03</td></tr>
</table>

Course Learning Objectives: This course will enable students to:

- Explain the principles of management, organization and entrepreneur.
- Discuss on planning, staffing, ERP and their importance
- Infer the importance of intellectual property rights and relate the institutional support

Module – 1	CH
Introduction - Meaning, nature and characteristics of management, scope and Functional areas of management, goals of management, levels of management, brief overview of evolution of management theories,. Planning- Nature, importance, types of plans, steps in planning, Organizing- nature and purpose, types of Organization, Staffing- meaning, process of recruitment and selection **RBT: L1, L2**	08
Module – 2	
Directing and controlling- meaning and nature of directing, leadership styles, motivationTheories, Communication- Meaning and importance, Coordination- meaning andimportance, Controlling- meaning, steps in controlling, methods of establishing control. **RBT: L1, L2**	08
Module – 3	
Entrepreneur – meaning of entrepreneur, characteristics of entrepreneurs, classification and types of entrepreneurs, various stages in entrepreneurial process, role of entrepreneurs in economic development, entrepreneurship in India and barriers to entrepreneurship. Identification of business opportunities, market feasibility study, technical feasibility study, financial feasibility study and social feasibility study. **RBT: L1, L2**	08
Module – 4	
Preparation of project and ERP - meaning of project, project identification, project selection, project report, need and significance of project report, contents, formulation, guidelines by planning commission for project report, **Enterprise Resource Planning: Meaning and Importance- ERP** and Functional areas of Management – Marketing / Sales- Supply Chain Management – Finance and Accounting – Human Resources – Types of reports and methods of report generation **RBT: L1, L2**	08
Module 5 **Micro and Small Enterprises:** Definition of micro and small enterprises, characteristics and advantages of micro and small enterprises, steps in establishing micro and small enterprises, Government of India indusial policy 2007 on micro and small enterprises, case study (Microsoft), Case study(Captain G R Gopinath),case study (N R Narayana Murthy &Infosys), **Institutional support:** MSME-DI, NSIC, SIDBI, KIADB, KSSIDC, TECSOK, KSFC, DIC and District level single window agency, **Introduction to IPR.** **RBT: L1, L2**	

Course outcomes: The students should be able to:

- Define management, organization, entrepreneur, planning, staffing, ERP and outline their importance in entrepreneurship
- Utilize the resources available effectively through ERP
- Make use of IPRs and institutional support in entrepreneurship

Question Paper Pattern:
• The question paper will have ten questions. • Each full Question consisting of 20 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module.
Textbooks:
1. Principles of Management -P. C. Tripathi, P. N. Reddy; Tata McGraw Hill, 4th / 6th Edition, 2010. 2. Dynamics of Entrepreneurial Development & Management -Vasant Desai Himalaya Publishing House. 3. Entrepreneurship Development -Small Business Enterprises -Poornima M Charantimath Pearson Education – 2006. 4. Management and Entrepreneurship - KanishkaBedi- Oxford University Press-2017
Reference Books:
1. Management Fundamentals -Concepts, Application, Skill Development Robert Lusier – Thomson. 2. Entrepreneurship Development -S S Khanka -S Chand & Co. 3. Management -Stephen Robbins -Pearson Education /PHI -17th Edition, 2003

PYTHON PROGRAMMING [(Effective from the academic year 2018 -2019) SEMESTER – V			
Subject Code	18AI52	**IA Marks**	40
Number of Lecture Hours/Week	3:2:0	**Exam Marks**	60
Total Number of Lecture Hours	50	**Exam Hours**	03
CREDITS – 04			

Course Learning Objectives: This course will enable students to:

- Learn the syntax and semantics of Python programming language.
- Illustrate the process of structuring the data using lists, tuples and dictionaries.
- Demonstrate the use of built-in functions to navigate the file system.
- Implement the Object Oriented Programming concepts in Python.
- Appraise the need for working with various documents like Excel, PDF, Word and Others.

Module – 1	**Contact Hours**
Python Basics, Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program,**Flow control,** Boolean Values, Comparison Operators, Boolean Operators,Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules,Ending a Program Early with sys.exit(), **Functions,**def Statements with Parameters, Return Values and return Statements,The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling, A Short Program: Guess the Number **Textbook 1: Chapters 1 – 3** **RBT: L1, L2**	10
Module – 2	
Lists, The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples,References, **Dictionaries and Structuring Data,** The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things, **Manipulating Strings,** Working with Strings, Useful String Methods, Project: Password Locker, Project: Adding Bullets to Wiki Markup **Textbook 1: Chapters 4 – 6** **RBT: L1, L2, L3**	10
Module – 3	
Pattern Matching with Regular Expressions, Finding Patterns of Text Without Regular Expressions, Finding Patterns of Text with Regular Expressions,More Pattern Matching with Regular Expressions, Greedy and Nongreedy Matching, The findall() Method, Character Classes, Making Your Own Character Classes, The Caret and Dollar Sign Characters, The Wildcard Character, Review of Regex Symbols, Case-Insensitive Matching, Substituting Strings with the sub() Method, Managing Complex Regexes, Combining re .IGNORECASE, re .DOTALL, and re .VERBOSE, Project: Phone Number and Email Address Extractor, **Reading and Writing Files,** Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module,Saving Variables with the pprint.pformat() Function, Project: Generating Random Quiz Files, Project: Multiclipboard. **Textbook 1: Chapters 7 – 10** **RBT: L1, L2, L3**	10

Module – 4	
Classes and objects, Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying, **Classes and functions,** Time, Pure functions, Modifiers, Prototyping versus planning, **Classes and methods,** Object-oriented features, Printing objects, Another example, A more complicated example,Theinit method, The __str__ method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation,**Inheritance,** Card objects, Class attributes, Comparing cards, Decks, Printing the deck, Add, remove, shuffle and sort, Inheritance, Class diagrams, Data encapsulation **Textbook 2: Chapters 15 – 18** **RBT: L1, L2, L3**	10
Module – 5	
Web Scraping, Project: MAPIT.PY with the webbrowser Module, Downloading Files from the Web with the requests Module, Saving Downloaded Files to the Hard Drive, HTML, Parsing HTML with the BeautifulSoup Module, Project: “I'm Feeling Lucky” Google Search,Project: Downloading All XKCD Comics, Controlling the Browser with the selenium Module, **Working with Excel Spreadsheets,** Excel Documents, Installing the openpyxl Module, Reading Excel Documents, Project: Reading Data from a Spreadsheet, Writing Excel Documents, Project: Updating a Spreadsheet, Setting the Font Style of Cells, Font Objects, Formulas, Adjusting Rows and Columns, Charts, **Working with PDF and Word Documents,** PDF Documents, Project: Combining Select Pages from Many PDFs, Word Documents, **Working with CSV files and JSON data,** The csv Module, Project: Removing the Header from CSV Files, JSON and APIs, The json Module, Project: Fetching Current Weather Data **Textbook 1: Chapters 11 – 14** **RBT: L1, L2, L3**	10

Course Outcomes: After studying this course, students will be able to

- Demonstrate proficiency in handling of loops and creation of functions.
- Identify the methods to create and manipulate lists, tuples and dictionaries.
- Discover the commonly used operations involving regular expressions and file system.
- Interpret the concepts of Object-Oriented Programming as used in Python.
- Determine the need for scraping websites and working with CSV, JSON and other file formats.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Al Sweigart,**“Automate the Boring Stuff with Python”,**1st Edition, No Starch Press, 2015. (Available under CC-BY-NC-SA license at https://automatetheboringstuff.com/) (Chapters 1 to 18)
2. Allen B. Downey, **“Think Python: How to Think Like a Computer Scientist”,** 2nd Edition, Green Tea Press, 2015. (Available under CC-BY-NC license at http://greenteapress.com/thinkpython2/thinkpython2.pdf) (Chapters 13, 15, 16, 17, 18) (Download pdf/html files from the above links)

Reference Books:

1. Jake VanderPlas, **"Python Data Science Handbook: Essential Tools for Working with Data",** 1st Edition, O'Reilly Media, 2016. ISBN-13: 978-1491912058
2. Charles Dierbach, **"Introduction to Computer Science Using Python",** 1st Edition, Wiley India Pvt Ltd, 2015. ISBN-13: 978-8126556014
3. Wesley J Chun, **"Core Python Applications Programming",** 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365

DATABASE MANAGEMENT SYSTEM (Effective from the academic year 2018 -2019) SEMESTER – V			
Subject Code	18CS53	**CIE Marks**	40
Number of Contact Hours/Week	3:2:0	**SEE Marks**	60
Total Number of Contact Hours	50	**Exam Hours**	3 Hrs
CREDITS –4			

Course Learning Objectives: This course will enable students to:

- Provide a strong foundation in database concepts, technology, and practice.
- Practice SQL programming through a variety of database problems.
- Demonstrate the use of concurrency and transactions in database
- Design and build database applications for real world problems.

Module 1	Contact Hours
Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications. **Overview of Database Languages and Architectures:** Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment. **Conceptual Data Modelling using Entities and Relationships:** Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, examples, Specialization and Generalization. **Textbook 1:Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.10** **RBT: L1, L2, L3**	10
Module 2	
Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations. **Relational Algebra:** Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra. **Mapping Conceptual Design into a Logical Design:** Relational Database Design using ER-to-Relational mapping. **SQL:** SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL. **Textbook 1: Ch4.1 to 4.5, 5.1 to 5.3, 6.1 to 6.5, 8.1; Textbook 2: 3.5** **RBT: L1, L2, L3**	10
Module 3	
SQL : Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL. **Database Application Development:** Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Case study: The internet Bookshop. **Internet Applications:** The three-Tier application architecture, The presentation layer, The Middle Tier **Textbook 1: Ch7.1 to 7.4; Textbook 2: 6.1 to 6.6, 7.5 to 7.7.** **RBT: L1, L2, L3**	10
Module 4	
Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. **Normalization Algorithms:** Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms **Textbook 1: Ch14.1 to 14.7, 15.1 to 15.6**	10

RBT: L1, L2, L3	
Module 5	
Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL. **Concurrency Control in Databases:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking. **Introduction to Database Recovery Protocols:** Recovery Concepts, NO-UNDO/REDO recovery based on Deferred update, Recovery techniques based on immediate update, Shadow paging, Database backup and recovery from catastrophic failures **Textbook 1: 20.1 to 20.6, 21.1 to 21.7, 22.1 to 22.4, 22.7.** **RBT: L1, L2, L3**	10

Course Outcomes: The student will be able to :

- Identify, analyze and define database objects, enforce integrity constraints on a database using RDBMS.
- Use Structured Query Language (SQL) for database manipulation.
- Design and build simple database systems
- Develop application to interact with databases.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Fundamentals of Database Systems, RamezElmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.
2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill

Reference Books:

1. SilberschatzKorth and Sudharshan, Database System Concepts, 6th Edition, Mc-GrawHill, 2013.
2. Coronel, Morris, and Rob, Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 2012.

<table>
<tr><td colspan="4" align="center">AUTOMATA THEORY AND COMPUTABILITY
(Effective from the academic year 2018 -2019)
SEMESTER – V</td></tr>
<tr><td>Subject Code</td><td>18CS54</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Contact Hours/Week</td><td>3:0:0</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Contact Hours</td><td>40</td><td>Exam Hours</td><td>3 Hrs</td></tr>
<tr><td colspan="4" align="center">CREDITS –3</td></tr>
<tr><td colspan="4">Course Learning Objectives: This course will enable students to:</td></tr>
<tr><td colspan="4">Introduce core concepts in Automata and Theory of Computation
Identify different Formal language Classes and their Relationships
Design Grammars and Recognizers for different formal languages
Prove or disprove theorems in automata theory using their properties
Determine the decidability and intractability of Computational problems</td></tr>
</table>

Module 1	**Contact Hours**
Why study the Theory of Computation, Languages and Strings: Strings, Languages. A Language Hierarchy, Computation, **Finite State Machines (FSM)**: Deterministic FSM, Regular languages, Designing FSM, Nondeterministic FSMs, From FSMs to Operational Systems, Simulators for FSMs, Minimizing FSMs, Canonical form of Regular languages, Finite State Transducers, Bidirectional Transducers. **Textbook 1: Ch 1,2, 3,4, 5.1 to 5.10** **RBT: L1, L2**	08
Module 2	
Regular Expressions (RE): what is a RE?, Kleene's theorem, Applications of REs, Manipulating and Simplifying REs. Regular Grammars: Definition, Regular Grammars and Regular languages. Regular Languages (RL) and Non-regular Languages: How many RLs, To show that a language is regular, Closure properties of RLs, to show some languages are not RLs. **Textbook 1: Ch 6, 7, 8: 6.1 to 6.4, 7.1, 7.2, 8.1 to 8.4** **RBT: L1, L2, L3**	08
Module 3	
Context-Free Grammars(CFG): Introduction to Rewrite Systems and Grammars, CFGs and languages, designing CFGs, simplifying CFGs, proving that a Grammar is correct, Derivation and Parse trees, Ambiguity, Normal Forms. Pushdown Automata (PDA): Definition of non-deterministic PDA, Deterministic and Non-deterministic PDAs, Non-determinism and Halting, alternative equivalent definitions of a PDA, alternatives that are not equivalent to PDA. **Textbook 1: Ch 11, 12: 11.1 to 11.8, 12.1, 12.2, 12,4, 12.5, 12.6** **RBT: L1, L2, L3**	08
Module 4	
Algorithms and Decision Procedures for CFLs: Decidable questions, Un-decidable questions. **Turing Machine**: Turing machine model, Representation, Language acceptability by TM, design of TM, Techniques for TM construction. Variants of Turing Machines (TM), The model of Linear Bounded automata. **Textbook 1: Ch 14: 14.1, 14.2, Textbook 2: Ch 9.1 to 9.8** **RBT: L1, L2, L3**	08
Module 5	
Decidability: Definition of an algorithm, decidability, decidable languages, Undecidable languages, halting problem of TM, Post correspondence problem. Complexity: Growth rate of functions, the classes of P and NP, Quantum Computation: quantum computers, Church-Turing thesis. **Applications:** G.1 Defining syntax of programming language, Appendix J: Security **Textbook 2: 10.1 to 10.7, 12.1, 12.2, 12.8, 12.8.1, 12.8.2** **Textbook 1: Appendix: G.1(only), J.1 & J.2**	08

RBT: L1, L2, L3	

Course Outcomes: The student will be able to :

- Acquire fundamental understanding of the core concepts in automata theory and Theory of Computation
- Learn how to translate between different models of Computation (e.g., Deterministic and Non-deterministic and Software models).
- Design Grammars and Automata (recognizers) for different language classes and become knowledgeable about restricted models of Computation (Regular, Context Free) and their relative powers.
- Develop skills in formal reasoning and reduction of a problem to a formal model, with an emphasis on semantic precision and conciseness.
- Classify a problem with respect to different models of Computation.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Elaine Rich, Automata, Computability and Complexity, 1st Edition, Pearson education,2012/2013
2. K L P Mishra, N Chandrasekaran , 3rd Edition, Theory of Computer Science, PhI, 2012.

Reference Books:

1. John E Hopcroft, Rajeev Motwani, Jeffery D Ullman, Introduction to AutomataTheory, Languages, and Computation, 3rd Edition, Pearson Education, 2013
2. Michael Sipser : Introduction to the Theory of Computation, 3rd edition, Cengage learning,2013
3. John C Martin, Introduction to Languages and The Theory of Computation, 3rd Edition, Tata McGraw –Hill Publishing Company Limited, 2013
4. Peter Linz, “An Introduction to Formal Languages and Automata”, 3rd Edition, NarosaPublishers, 1998
5. Basavaraj S. Anami, Karibasappa K G, Formal Languages and Automata theory, Wiley India, 2012
6. C K Nagpal, Formal Languages and Automata Theory, Oxford University press, 2012.

Faculty can utilize open source tools (like JFLAP) to make teaching and learning more interactive.

PRINCIPLES OF ARTIFICIAL INTELLIGENCE (Effective from the academic year 2018 -2019) SEMESTER – V			
Subject Code	18AI55	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs
CREDITS – 03			

Course Learning Objectives: This course will enable students to:

1.Gain a historical perspective of AI and its foundations.
2. Become familiar with basic principles of AI toward problem solving
3.Get to know approaches of inference, perception, knowledge representation, and learning.

Module – 1	CH
Introduction to AI: history, Intelligent systems, foundation and sub area of AI , applications, current trend and development of AI. **Problem solving**: state space search and control strategies. **Chapter 1 and 2** **RBT: L1, L2**	08
Module – 2	
Problem reduction and Game playing : Problem reduction, game playing, Bounded look-ahead strategy, alpha-beta pruning, Two player perfect information games **Chapter 3** **RBT: L1, L2**	08
Module – 3	
Logic concepts and logic Programming: propositional calculus, Propositional logic, natural deduction system, semantic tableau system, resolution refutation, predicate logic, Logic programming. **Chapter 4** **RBT: L1, L2**	08
Module – 4	
Advanced problem solving paradigm: Planning: types of planning sytem, block world problem, logic based planning, Linear planning using a goal stack, Means-ends analysis, Non linear planning strategies, learning plans **Chapter 6.** **RBT: L1, L2**	08
Module – 5	
Knowledge Representation , Expert system Approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, Knowledge representation using Frames. Expert system: introduction phases, architecture ES verses Traditional system **Chapter 7 and 8 (8.1 to 8.4)** **RBT: L1, L2**	08

Course outcomes: The students should be able to:

- Apply the knowledge of Artificial Intelligence to write simple algorithm for agents.
- Apply the AI knowledge to solve problem on search algorithm.
- Develop knowledge base sentences using propositional logic and first order logic.
- Apply first order logic to solve knowledge engineering process.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Saroj Kaushik, Artificial Intelligence, Cengage learning, 2014

Reference Books:

1. Elaine Rich, Kevin Knight, Artificial Intelligence, Tata McGraw Hill
2. Nils J. Nilsson, Principles of Artificial Intelligence, Elsevier, 1980
3. StaurtRussel, Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson Education, 3rd Edition, 2009
4. George F Lugar, Artificial Intelligence Structure and strategies for complex, Pearson Education, 5th Edition, 2011

MATHEMATICS FOR MACHINE LEARNING (Effective from the academic year 2018 -2019) SEMESTER – V			
Subject Code	18AI56	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs
CREDITS – 03			

Course Learning Objectives: This course will enable students to:

- Improve the skills and knowledge in linear algebra to get more out of machine learning.
- Understand the vector calculus required to build many common machine learning techniques.
- Learn the probability and distribution in statistics to build machine learning applications.
- Learn the basic theoretical properties of optimization problems, for applications in machine learning

Module – 1	CH
Linear Algebra-Part1: Introduction,Matrices , System of Linear Equations, Vector Spaces, Linear Dependence and Independence, Gaussian Elimination, Basis and basis set, Rank, Norms , Inner Products, Lengths and Distances, Angles **(Ch: 2-2.6, Ch:3-3.3)** **RBT: L1, L2**	08
Module – 2	
Linear Algebra-Part2: Orthogonality, Orthonormal Basis, Orthogonal Complement, Rotations, Determinant and Trace, Eigenvalues and Eigenvectors – its interpretations, Projections, Regression, Diagonalization, Singular Value Decomposition**(Ch:3.4-3.6, 3.9, Ch:4-4.5)** **RBT: L1, L2**	08
Module – 3	
Vector Calculus: Introduction, Differentiation of Univariate Functions, Partial Differentiation and Gradients, Gradients of Vector-Valued Functions, Gradients of Matrices, Useful Identities for Computing Gradients, Backpropagation **(Ch-5)** **RBT: L1, L2**	08
Module – 4	
Probability and Distribution: Probability concepts, Conditional probability, Bayes' Theorem, Discrete and Continuous Random Variables and Distributions, Expectation and its Interpretations, Standard discrete and continuous distribution functions, Central Limit theorem **(Ch-6)** **RBT: L1, L2**	08
Module – 5	
Optimization: Introduction, Optimization Using Gradient Descent, Constrained Optimization and Lagrange Multipliers, Convex Optimization **(Ch-7)** **RBT: L1, L2**	08

Course outcomes: The students should be able to:

- Improve the skills and knowledge in linear algebra to get more out of machine learning.
- Understand the vector calculus required to build many common machine learning techniques.
- Learn the probability and distribution in statistics to build machine learning applications.
- Learn the basic theoretical properties of optimization problems, for applications in machine learning

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong. "Mathematics for Machine Learning" , Published by Cambridge University Press, Copyright 2020

Reference Books:

1. Sheldon Axler, “Linear Algebra Done Right” third edition, 2015, Springer
2. David C. Lay, “Linear Algebra and its Applications,” 3rd edition, Pearson Education (Asia) Pte. Ltd,2005.
3. Gilbert Strang, "Linear Algebra and its Applications”, 3rd edition, Thomson Learning Asia, 2003.
4. D. Chatterjee, “Analytical Geometry: Two and Three Dimensions”, Alpha Science International Limited, 2009
5. Charles M. Grinstead, J. Laurie Snell, “Introduction to Probability”.
6. DasGupta, Anirban, “Probability for Statistics and Machine Learning: Fundamentals and Advanced Topics” , Springer, 2011
7. David Morin, “Probability: For the Enthusiastic Beginner”, 2016
8. V. Jeyakumar, Alexander M. Rubinov, “ Continuous Optimization: Current Trends and Modern Applications(Applied Optimization) 2005th Edition
9. Kulkarni, Anand J., Satapathy, Suresh Chandra, “Optimization in Machine Learning and Applications”, Springer, 2020

ARTIFICIAL INTELLIGENCE LABORATORY (Effective from the academic year 2018 -2019) SEMESTER – V			
Subject Code	18AIL57	**CIE Marks**	40
Number of Contact Hours/Week	0:2:2	**SEE Marks**	60
Total Number of Lab Contact Hours		**Exam Hours**	3 Hrs
Credits – 2			

Course Learning Objectives: This course will enable students to:

- Implement and evaluate AI algorithms in Python programming language.

Descriptions (if any):

Installation procedure of the required software must be demonstrated, carried out in groups and documented in the journal.

Programs List:

Practicing Problems in Python(Students can be encouraged to practice good number of practice problems , some practice problems are listed here)

1.	(a) Write a python program to print the multiplication table for the given number (b) Write a python program to check whether the given number is prime or not? (c) Write a python program to find factorial of the given number?
2.	(a) Write a python program to implement List operations (Nested List, Length,Concatenation, Membership, Iteration, Indexing and Slicing) (b) Write a python program to implement List methods (Add, Append, Extend & Delete).
3.	Write a python program to implement simple Chatbot with minimum 10 conversations
4.	Write a python program to Illustrate Different Set Operations
5.	(a)Write a python program to implement a function that counts the number of times a string(s1) occurs in another string(s2) (b)Write a program to illustrate Dictionary operations([],in,traversal)and methods: keys(),values(),items()

AI Problems to be implemented in Python

1	Implement and Demonstrate Depth First Search Algorithm on Water Jug Problem
2	Implement and Demonstrate Best First Search Algorithm on any AI problem
3	Implement AO* Search algorithm.
4	Solve 8-Queens Problem with suitable assumptions
5	Implementation of TSP using heuristic approach
6	Implementation of the problem solving strategies: either using Forward Chaining or Backward Chaining
7	Implement resolution principle on FOPL related problems
8	Implement any Game and demonstrate the Game playing strategies

Laboratory Outcomes: The student should be able to:

- Implement and demonstrate AI algorithms.
- Evaluate different algorithms.

Conduct of Practical Examination:

- Experiment distribution
  - For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
  - For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.
- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution *(Subjected to change in accoradance with university regulations)*
  - i) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
  - j) For laboratories having PART A and PART B
    - i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
    - ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

DBMS LABORATORY WITH MINI PROJECT
(Effective from the academic year 2018 -2019)
SEMESTER – V

Subject Code	18CSL58	**CIE Marks**	40
Number of Contact Hours/Week	0:2:2	**SEE Marks**	60
Total Number of Lab Contact Hours		**Exam Hours**	3 Hrs

Credits – 2

Course Learning Objectives: This course will enable students to:

- Foundation knowledge in database concepts, technology and practice to groom students into well-informed database application developers.
- Strong practice in SQL programming through a variety of database problems.
- Develop database applications using front-end tools and back-end DBMS.

Descriptions (if any):

PART-A: SQL Programming ()

- Design, develop, and implement the specified queries for the following problems using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment.
- Create Schema and insert at least 5 records for each table. Add appropriate database constraints.

PART-B: Mini Project ()

- Use Java, C#, PHP, Python, or any other similar front-end tool. All applications must be demonstrated on desktop/laptop as a stand-alone or web based application (Mobile apps on Android/IOS are not permitted.)

.

Installation procedure of the required software must be demonstrated, carried out in groups and documented in the journal.

Programs List:

PART A

1. Consider the following schema for a Library Database:
BOOK(Book_id, Title, Publisher_Name, Pub_Year)
BOOK_AUTHORS(Book_id, Author_Name)
PUBLISHER(Name, Address, Phone)
BOOK_COPIES(Book_id, Branch_id, No-of_Copies)
BOOK_LENDING(Book_id, Branch_id, Card_No, Date_Out, Due_Date)
LIBRARY_BRANCH(Branch_id, Branch_Name, Address)
Write SQL queries to
    1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each branch, etc.
    2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017.
    3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.
    4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query.
    5. Create a view of all books and its number of copies that are currently available in the Library.

2. Consider the following schema for Order Database:
SALESMAN(Salesman_id, Name, City, Commission)
CUSTOMER(Customer_id, Cust_Name, City, Grade, Salesman_id)
ORDERS(Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)
Write SQL queries to
    1. Count the customers with grades above Bangalore's average.
    2. Find the name and numbers of all salesman who had more than one customer.
    3. List all the salesman and indicate those who have and don't have customers in their cities (Use UNION operation.)
    4. Create a view that finds the salesman who has the customer with the highest order

<table>
<tr><td></td><td>of a day.
5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.</td></tr>
<tr><td>3.</td><td>Consider the schema for Movie Database:
ACTOR(Act_id, Act_Name, Act_Gender)
DIRECTOR(Dir_id, Dir_Name, Dir_Phone)
MOVIES(Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id)
MOVIE_CAST(Act_id, Mov_id, Role)
RATING(Mov_id, Rev_Stars)
Write SQL queries to
1. List the titles of all movies directed by ‘Hitchcock’.
2. Find the movie names where one or more actors acted in two or more movies.
3. List all actors who acted in a movie before 2000 and also in a movie after 2015 (use JOIN operation).
4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title.
5. Update rating of all movies directed by ‘Steven Spielberg’ to 5.</td></tr>
<tr><td>4.</td><td>Consider the schema for College Database:
STUDENT(USN, SName, Address, Phone, Gender)
SEMSEC(SSID, Sem, Sec)
CLASS(USN, SSID)
SUBJECT(Subcode, Title, Sem, Credits)
IAMARKS(USN, Subcode, SSID, Test1, Test2, Test3, FinalIA)
Write SQL queries to
1. List all the student details studying in fourth semester ‘C’ section.
2. Compute the total number of male and female students in each semester and in each section.
3. Create a view of Test1 marks of student USN ‘1BI15CS101’ in all subjects.
4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students.
5. Categorize students based on the following criterion:
If FinalIA = 17 to 20 then CAT = ‘Outstanding’
If FinalIA = 12 to 16 then CAT = ‘Average’
If FinalIA< 12 then CAT = ‘Weak’
Give these details only for 8th semester A, B, and C section students.</td></tr>
<tr><td>5.</td><td>Consider the schema for Company Database:
EMPLOYEE(SSN, Name, Address, Sex, Salary, SuperSSN, DNo)
DEPARTMENT(DNo, DName, MgrSSN, MgrStartDate)
DLOCATION(DNo,DLoc)
PROJECT(PNo, PName, PLocation, DNo)
WORKS_ON(SSN, PNo, Hours)
Write SQL queries to
1. Make a list of all project numbers for projects that involve an employee whose last name is ‘Scott’, either as a worker or as a manager of the department that controls the project.
2. Show the resulting salaries if every employee working on the ‘IoT’ project is given a 10 percent raise.
3. Find the sum of the salaries of all employees of the ‘Accounts’ department, as well as the maximum salary, the minimum salary, and the average salary in this department
4. Retrieve the name of each employee who works on all the projects controlledby department number 5 (use NOT EXISTS operator).
5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6,00,000.</td></tr>
<tr><td colspan="2">PART B: Mini Project</td></tr>
</table>

•	**For any problem selected make sure that the application should have five or more tables indicative areas include; health care , salary management, office automation, etc.**

Laboratory Outcomes: The student should be able to:

- Create, Update and query on the database.
- Demonstrate the working of different concepts of DBMS
- Implement, analyze and evaluate the project developed for an application.

Conduct of Practical Examination:

- Experiment distribution
  - For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
  - For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.
- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution *(Subjected to change in accoradance with university regulations)*
  - k) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
  - l) For laboratories having PART A and PART B
    - i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
    - ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

MACHINE LEARNING
(Effective from the academic year 2018 -2019)
SEMESTER – VI

Subject Code	18AI61	**CIE Marks**	40
Number of Contact Hours/Week	3:2:0	**SEE Marks**	60
Total Number of Contact Hours	50	**Exam Hours**	3 Hrs

CREDITS – 04

Course Learning Objectives: This course will enable students to:

- Define machine learning and understand the basic theory underlying machine learning.
- Differentiate supervised, unsupervised and reinforcement learning
- Understand the basic concepts of learning and decision trees.
- Understand Bayesian techniques for problems appear in machine learning
- Perform statistical analysis of machine learning techniques.

Module – 1	**CH**
Introduction: Machine learning Landscape: what is ML?, Why, Types of ML, main challenges of ML (T2:Chapter1) **Concept learning and Learning Problems** – Designing Learning systems, Perspectives and Issues – Concept Learning – Find S-Version Spaces and Candidate Elimination Algorithm –Remarks on VS- Inductive bias – **T2: Chapter 1** **T1:Chapter 1 and 2)**	10
Module – 2	
End to end Machine learning Project : Working with real data, Look at the big picture, Get the data, Discover and visualize the data, Prepare the data, select and train the model, Fine tune your model **Classification** : MNIST, training a Binary classifier, performance measure, multiclass classification, error analysis, multi label classification, multi output classification **(T2: Chapter 2 and 3)**	10
Module – 3	
Training Models: Linear regression, gradient descent, polynomial regression, learning curves, regularized linear models, logistic regression Support Vector Machine: linear, Nonlinear , SVM regression and under the hood **(T2: Chapter 4 and 5)** **RBT: L1, L2**	10
Module – 4	
Decision Trees Training and Visualizing DT, making prediction, estimating class, the CART training, computational complexity, GINI impurity, Entropy, regularization Hyper parameters, Regression, instability **Ensemble learning and Random Forest**: Voting classifiers, Bagging and pasting, Random patches, Random forests, Boosting, stacking **(T2: Chapter 6 and 7)** **RBT: L1, L2**	10
Module – 5	
Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier– example- Bayesian Belief Network – EM Algorithm **Text book (T1: Chapter 6)** **RBT: L1, L2**	10

Course outcomes: The students should be able to:

- Choose the learning techniques with this basic knowledge.
- Apply effectively ML algorithms for appropriate applications.
- Apply bayesian techniques and derive effectively learning rules.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Tom M. Mitchell, Machine Learning, McGraw-Hill Education, 2013
2. AurelienGeron, Hands-on Machine Learning with Scikit-Learn &TensorFlow , O'Reilly, Shroff Publishers and Distributors pvt.Ltd 2019

Reference Books:

1. EthemAlpaydin, Introduction to Machine Learning, PHI Learning Pvt. Ltd, 2nd Ed., 2013
2. T. Hastie, R. Tibshirani, J. H. Friedman, The Elements of Statistical Learning, Springer, 1st edition, 2001
3. Machine Learning using Python ,Manaranjan Pradhan, U Dinesh kumar, Wiley, 2019
4. Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson,2020

DIGITAL IMAGE PROCESSING (Effective from the academic year 2018 -2019) SEMESTER – VI			
Subject Code	18AI62	**CIE Marks**	40
Number of Contact Hours/Week	3:2:0	**SEE Marks**	60
Total Number of Contact Hours	50	**Exam Hours**	03
CREDITS –4			

- **Course Learning Objectives:** This course will enable students to:
- Understand the fundamentals of digital image processing
- Understand the image transform used in digital image processing
- Understand the image enhancement techniques used in digital image processing
- Understand the image restoration techniques and methods used in digital imageprocessing
- Understand the Morphological Operations and Segmentation used in digital image processing

Module-1	**Contact Hours.**
Digital Image Fundamentals: What is Digital Image Processing?,Originsof Digital Image Processing, Examples of fields that use DIP, FundamentalSteps in Digital Image Processing, Components of an Image ProcessingSystem, Elements of Visual Perception, Image Sensing and Acquisition,Image Sampling and Quantization, Some Basic Relationships betweenPixels, Linear and Nonlinear Operations. [Text1: Chapter 1 and Chapter 2: Sections 2.1 to 2.5, 2.6.2]	10
RBT: L1,L2	
Module-2	
Spatial Domain: Some Basic Intensity Transformation Functions,Histogram Processing, Fundamentals of Spatial Filtering,-SmoothingSpatial Filters, Sharpening SpatialFilters**Frequency Domain**: Preliminary Concepts, The Discrete FourierTransform (DFT) of Two Variables, Properties of the 2-D DFT, Filtering inthe Frequency Domain, Image Smoothing and Image Sharpening UsingFrequency Domain Filters, and Selective Filtering. [Text1: Chapter 3: Sections 3.2 to 3.6 and Chapter 4: Sections 4.2, 4.5 to4.10]	10
RBT: L1,L2, L3	
Module-3	
Restoration: Noise models, Restoration in the Presence of Noise Onlyusing Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, InverseFiltering, Minimum Mean Square Error (Wiener) Filtering, and ConstrainedLeast Squares Filtering. [Text1: Chapter 5: Sections 5.2, to 5.9]	10
RBT: L1,L2, L3	
Module-4	
Color Image Processing: Color Fundamentals, Color Models, and Pseudo-colorImage Processing. **Wavelets:** Background, Multiresolution Expansions. **Morphological Image Processing:** Preliminaries, Erosion and Dilation,Opening and Closing,	10

The Hit-or-Miss Transforms, and Some BasicMorphological Algorithms. [Text1: Chapter 6: Sections 6.1 to 6.3, Chapter 7: Sections 7.1 and 7.2,Chapter 9: Sections 9.1 to 9.5]	
RBT: L1,L2, L3	
Module-5	
Segmentation: Introduction, classification of image segmentation algorithms, Detection of Discontinuities, Edge Detection, Hough Transforms and Shape Detection, Corner Detection, and Principles of Thresholding. **Representation and Description:** Representation, and Boundary descriptors. [Text2: Chapter 9: Sections 9.1, to 9.7 and Text 1: Chapter 11: Sections 11.1and 11.2]	10
RBT: L1,L2, L3	

Course Outcomes: At the end of the course students should be able to:

- Understand, Ascertain and describe the basics of image processing concepts through mathematical interpretation.
- Apply image processing techniques in both the spatial and frequency (Fourier)domains.
- Demonstrate image restoration process and its respective filters required.
- Design image analysis techniques in the form of image segmentation and toevaluate the Methodologies for segmentation.
- Conduct independent study and analysis of Image Enhancement techniques.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Third Ed., Prentice Hall, 2008.
2. S. Sridhar, Digital Image Processing, Oxford University Press, 2ndEdition, 2016.

Reference Books:

1. Digital Image Processing- S.Jayaraman, S.Esakkirajan, T.Veerakumar, TataMcGraw Hill 2014.
2. Fundamentals of Digital Image Processing-A. K. Jain, Pearson 2004.

<table>
<tr><td colspan="4">JAVA FOR MOBILE APPLICATIONS
(Effective from the academic year 2018 -2019)
SEMESTER – VI</td></tr>
<tr><td>Subject Code</td><td>18AI63</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Contact Hours/Week</td><td>3:2:0</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Contact Hours</td><td>50</td><td>Exam Hours</td><td>3 Hrs</td></tr>
<tr><td colspan="4">CREDITS –4</td></tr>
<tr><td colspan="4">Course Learning Objectives: This course will enable students to:</td></tr>
<tr><td colspan="4">• To have an insight into enumerations and collection frameworks for storing and processing data.
• To understand the architecture and components of android application.
• To design interactive user interface.
• To work with SQLite database</td></tr>
</table>

<table>
<tr><td>Module 1</td><td>Contact Hours</td></tr>
<tr><td>Enumerations, Autoboxing and Annotations(metadata): Enumerations, Enumeration fundamentals, the values () and valueOf() Methods, java enumerations are class types, enumerations Inherits Enum, example, type wrappers, Autoboxing, Autoboxing and Methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of Warning. Annotations, Annotation basics, specifying retention policy, Obtaining Annotations at run time by use of reflection, Annotated element Interface, Using Default values, Marker Annotations, Single Member annotations, Built-In annotations.
RBT: L2, L3</td><td>10</td></tr>
<tr><td>Module 2</td><td></td></tr>
<tr><td>The collections and Framework: Collections Overview, Recent Changes to Collections, The Collection Interfaces, The Collection Classes, accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working with Maps, Comparators, The Collection Algorithms, Why Generic Collections? The legacy Classes and Interfaces, Parting Thoughts on Collections
RBT: L1, L2</td><td>10</td></tr>
<tr><td>Module 3</td><td></td></tr>
<tr><td>String Handling: The String Constructors, String Length, Special String Operations, String Literals, String Concatenation, String Concatenation with Other Data Types, String Conversion and toString( ) Character Extraction, charAt( ), getChars( ), getBytes( ) toCharArray(), String Comparison, equals( ) and equalsIgnoreCase( ), regionMatches( ) startsWith( ) and endsWith( ), equals( ) Versus ==, compareTo( ) Searching Strings, Modifying a String, substring( ), concat( ), replace( ), trim( ), Data Conversion Using valueOf( ), Changing the Case of Characters Within a String, Additional String Methods, StringBuffer, StringBuffer Constructors, length( ) and capacity( ), ensureCapacity( ), setLength( ), charAt( ) and setCharAt( ), getChars( ),append( ), insert( ), reverse( ), delete( ) and deleteCharAt( ), replace( ), substring( ), Additional StringBuffer Methods, StringBuilder Text Book 1: Ch 15</td><td>10</td></tr>
<tr><td>Module 4</td><td></td></tr>
<tr><td>Getting Started with Android Programming: What is Android? Features of Android, Android Architecture, obtaining the required tools, launching your first android application Activities, Fragments and Intents: Understanding activities, linking activities using intents, fragments.Text Book 3: Ch 1, 3</td><td>10</td></tr>
</table>

RBT: L1, L2, L3	
Module 5	
Getting to know the Android User Interface: Views and ViewGroups, FrameLayout, LinearLayout, TableLayout, RelativeLayout, ScrollView **Designing User Interface with Views:** TextView view – Button, ImageButton, EditText, Checkbox, ToggleButton, RadioButton and RadioGroupViews. **Creating and using Databases:** Creating the DBAdapter Helper class, using the database programmatically. **Text Book 3: Ch 4.1, 5.1, 7.3** **RBT: L1, L2, L3**	10

Course Outcomes: The student will be able to:

- Interpret the need for advanced Java concepts like enumerations and collections in developing modular and efficient programs
- Understand various application components in android.
- Design efficient user interface using different layouts.
- Develop application with persistent data storage using SQLite

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1.Herbert Schildt: JAVA the Complete Reference, 7th/9th Edition, Tata McGraw Hill, 2007.
2.Jim Keogh: J2EE-TheCompleteReference, McGraw Hill, 2007
3.J. F. DiMarzio, Beginning Android Programming with Android Studio, 4th Edition, 2017

Reference Books:

1. John Horton,Android Programming for Beginners, 1st Edition, 2015
2.Dawn Griffiths & David Griffiths, Head First Android Development, O'Reilly, 1st Edition, 2015

<table>
<tr><td colspan="4" align="center">NATURAL LANGUAGE PROCESSING
(Effective from the academic year 2018 -2019)
SEMESTER – VI</td></tr>
<tr><td>Subject Code</td><td>18AI641</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Contact Hours/Week</td><td>3:0:0</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Contact Hours</td><td>40</td><td>Exam Hours</td><td>3 Hrs</td></tr>
<tr><td colspan="4" align="center">CREDITS – 03</td></tr>
<tr><td colspan="4">Course Learning Objectives: This course will enable students to:</td></tr>
<tr><td colspan="4">Analyze the natural language text.
Define the importance of natural language.
Understand the concepts Text mining.
Illustrate information retrieval techniques.</td></tr>
</table>

<table>
<tr><td>Module – 1</td><td>Contact Hours</td></tr>
<tr><td>Overview and language modeling: Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.
Textbook 1: Ch. 1,2
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="2">Module – 2</td></tr>
<tr><td>Word level and syntactic analysis: Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency-Parsing-Probabilistic Parsing.
Textbook 1: Ch. 3,4
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="2">Module – 3</td></tr>
<tr><td>Extracting Relations from Text: From Word Sequences to Dependency Paths: Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation.
Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to Annotate Cases with Knowledge Roles and Evaluations.
A Case Study in Natural Language Based Web Search: InFact System Overview, The GlobalSecurity.org Experience.
Textbook 2: Ch. 3,4,5
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="2">Module – 4</td></tr>
<tr><td>Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems,
Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures: Introduction, Cohesion, Coh-Metrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of Experiments.
Automatic Document Separation: A Combination of Probabilistic Classification and Finite-State Sequence Modeling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results.
Evolving Explanatory Novel Patterns for Semantically-Based Text Mining: Related Work, A Semantically Guided Model for Effective Text Mining.
Textbook 2: Ch. 6,7,8,9
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="2">Module – 5</td></tr>
<tr><td>Information Retrieval And Lexical Resources: Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information</td><td>08</td></tr>
</table>

Retrieval – valuation Lexical Resources: World Net-Frame Net- Stemmers-POS Tagger- Research Corpora. **Textbook 1: Ch. 9,12** **RBT: L1, L2, L3**	

Course outcomes: The students should be able to:

- Analyze the natural language text.
- Define the importance of natural language.
- Understand the concepts Text mining.
- Illustrate information retrieval techniques.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
2. Anne Kao and Stephen R. Poteet (Eds), “Natural LanguageProcessing and Text Mining”, Springer-Verlag London Limited 2007.

Reference Books:

1. Daniel Jurafsky and James H Martin, “Speech and Language Processing: Anintroduction to Natural Language Processing, Computational Linguistics and SpeechRecognition”, 2nd Edition, Prentice Hall, 2008.
2. James Allen, “Natural Language Understanding”, 2nd edition, Benjamin/Cummingspublishing company, 1995.
3. Gerald J. Kowalski and Mark.T. Maybury, “Information Storage and Retrieval systems”, Kluwer academic Publishers, 2000.

SOFTWARE PROJECT MANAGEMENT
(Effective from the academic year 2018 -2019)
SEMESTER – VI

Subject Code	18AI642	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs

CREDITS – 03

Course Learning Objectives: This course will enable students to:

- Understand the basics of software project management concepts, principles and practices.
- Understand the different methods of estimation for software project.
- Understand the basic concepts, principles and practices of software project scheduling and riskmanagement.
- Analyse a software project based on various review metrics with review guidelines.
- Understand software project maintenance, reengineering and configuration management.

Module – 1	**Contact Hours**
Project Management Concepts: The Management Spectrum – The People, The Products, The Process, TheProject, People -The Stakeholders, Team Leaders, The Software Team, Agile Teams, Coordination AndCommunication Issues, The Product – Software Scope, Problem Decomposition, The Process – Melding TheProductsAnd The Process, Process Decomposition, The Project, The W5HH Principle, Critical Practices. **T1: Chapter 31** **RBT: L1, L2**	08
Module – 2	
Metrics in the Process and Project Domains -Process Metrics And Software Process Improvement, ProjectMetrics, Software Measurement – Size-Oriented Metrics, Function-Oriented Metrics, Reconciling LOC AndFP Metrics, Object-Oriented Metrics, Use Cases- Oriented Metrics, Webapp Project Metrics, Metrics ForSoftware Quality – Measuring Quality ,Defect Removal Efficiency, Integrating Metrics With The SoftwareProcess - Arguments For Software Metrics, Establishing A Baseline, Metrics Collection Computation AndEvaluation, Metrics For Small Organisation, Establishing A Software Metrics Program. **T1: Chapter 32** **RBT: L1, L2**	08
Module – 3	
Estimation for Software Project: Observations On Estimation, The Project Planning Process, SoftwareScope And Feasibility, Resources – Human Resources, Reusable Software Resources, EnvironmentalResources, Software Project Estimation, Decomposition Techniques – Software Sizing, Problem BasedEstimation, An Example Of LOC Based Estimation, An Example Of FP – Based Estimation, Process-BasedEstimation, An Example Of Process- Based Estimation, Estimation With Usecases, An Example Of EstimationUsing Use Case Points, Reconciling Estimates, Empirical Estimation Models – The Structure Of EstimationModels, The COCOMO II Model, The Software Equation. **T1: Chapter 33** **RBT: L1, L2**	08
Module – 4	

Project Scheduling: Basic concepts, Project Scheduling – Basic Principles - The Relationship BetweenPeople and Effort – Effort Distribution, defining a Task Set for The Software Project – a Task Set Example –Refinement of Major Tasks, defining a Task Network, Scheduling – Timeline Charts – Tracking the Schedule– Tracking Progress for an OO Project. **T1: Chapter 34** **RBT: L1, L2**	08
Module – 5	
Software Quality: What is Quality? Software Quality – Garvin's Quality Dimensions, McColl"sQualityFactors, ISO 9126 Quality Factors, Targeted Quality Factors, The Transition to a Quantitative View, TheSoftware Quality Dilemma - "Good Enough" Software, The Cost Of Quality, Risks, Negligence and Liability,Quality and Security, The Impact Of Management Actions, Achieving Software Quality – SoftwareEngineering Methods, Project Management Techniques, Quality Control, Quality Assurance. **T1: Chapter 19** **RBT: L1, L2**	08

Course outcomes: The students should be able to:

- Describe the basics of software project management concepts, principles and practices.
- Apply the different metrics and techniques to measure a software project.
- Apply software cost estimation models.
- Apply scheduling techniques to software project.
- Discuss the software quality concepts and good practices.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Software Engineering: APractitioner'sApproachRoger S. Pressman, BruceMaximMcGraw Hill 8th Edition,2015

Reference Books:

1. Software Project ManagementBobHughesMikeCotterellRajibMallMcGraw Hill 6th Edition 2018
2. Managing the Software ProcessWattsHumphreyPearson Education 2000
3. Software Project Management inpracticePankajJalote Pearson Education 2002

WEB PROGRAMMING (Effective from the academic year 2018 -2019) SEMESTER – VI			
Subject Code	18AI643	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs
CREDITS –4			

Course Learning Objectives: This course will enable students to:

- Illustrate the Semantic Structure of HTML and CSS
- Compose forms and tables using HTML and CSS
- Design Client-Side programs using JavaScript and Server-Side programs using PHP
- Infer Object Oriented Programming capabilities of PHP
- Examine JavaScript frameworks such as jQuery and Backbone

Module 1	**Contact Hours**
Introduction to HTML, What is HTML and Where did it come from?, HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements, Introduction to CSS, What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling. **Textbook 1: Ch. 2, 3** **RBT: L1, L2, L3**	8
Module 2	
HTML Tables and Forms, Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility, Microformats, Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks. **Textbook 1: Ch. 4,5** **RBT: L1, L2, L3**	8
Module 3	
JavaScript: Client-Side Scripting, What is JavaScript and What can it do?, JavaScript Design Principles, Where does JavaScript Go?, Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms, Introduction to Server-Side Development with PHP, What is Server-Side Development, A Web Server's Responsibilities, Quick Tour of PHP, Program Control, Functions **Textbook 1: Ch. 6, 8** **RBT: L1, L2, L3**	8
Module 4	
PHP Arrays and Superglobals, Arrays, $_GET and $_POST Superglobal Arrays, $_SERVER Array, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design, Error Handling and Validation, What are Errors and Exceptions?, PHP Error Reporting, PHP Error and Exception Handling **Textbook 1: Ch. 9, 10** **RBT: L1, L2, L3**	8
Module 5	
Managing State, The Problem of State in Web Applications, Passing Information via Query Strings, Passing Information via the URL Path, Cookies, Serialization, Session State, HTML5 Web Storage, Caching, Advanced JavaScript and jQuery, JavaScript Pseudo-Classes, jQuery Foundations, AJAX, Asynchronous File Transmission, Animation, Backbone MVC Frameworks, XML Processing and Web Services, XML Processing, JSON, Overview of Web Services. **Textbook 1: Ch. 13, 15,17** **RBT: L1, L2, L3**	8

Course Outcomes: The student will be able to :

- Adapt HTML and CSS syntax and semantics to build web pages.
- Construct and visually format tables and forms using HTML and CSS
- Develop Client-Side Scripts using JavaScript and Server-Side Scripts using PHP to generate and display the contents dynamically.
- Appraise the principles of object oriented development using PHP
- Inspect JavaScript frameworks like jQuery and Backbone which facilitates developer to focus on core features.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Randy Connolly, Ricardo Hoar, **"Fundamentals of Web Development",** 1stEdition, Pearson Education India. (**ISBN:**978-9332575271)

Reference Books:

1. Robin Nixon, **"Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5",** 4thEdition, O'Reilly Publications, 2015. (**ISBN:**978-9352130153)
2. Luke Welling, Laura Thomson, **"PHP and MySQL Web Development",** 5th Edition, Pearson Education, 2016. (**ISBN:**978-9332582736)
3. Nicholas C Zakas, **"Professional JavaScript for Web Developers",** 3rd Edition, Wrox/Wiley India, 2012. (**ISBN:**978-8126535088)
4. David Sawyer Mcfarland, **"JavaScript & jQuery: The Missing Manual",** 1st Edition, O'Reilly/Shroff Publishers & Distributors Pvt Ltd, 2014

Mandatory Note:

Distribution of CIE Marks is a follows (Total 40 Marks):

- 20 Marks through IA Tests
- 20 Marks through practical assessment

Maintain a copy of the report for verification during LIC visit.

FOUNDATION FOR DATA SCIENCE
(Effective from the academic year 2018 -2019)
SEMESTER – VI

Subject Code	18AI644	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs

CREDITS – 03

Course Learning Objectives: This course will enable students to:

- Understand the knowledge of mathematics to explain the concept of data science
- Design Decision tree to predict the class for a given data
- Analyze the given data set, and solve a problem by performing Classification using the basics of mathematics and data science
- Develop solutions to group entities in data set and apply it for the given real-world data using the basic knowledge of similarity, neighbors and clustering

Module – 1	CH
Introduction: Data-Analytic Thinking: The Ubiquity of Data Opportunities, Example: Hurricane Frances, Example: Predicting Customer Churn. Data Science, Engineering, and Data-Driven Decision Making, Data Processing and ―Big Data‖, Data and Data Science Capability as a Strategic Asset, Data-Analytic Thinking. **Business Problems and Data Science Solutions:** From Business Problems to Data Mining Tasks, Supervised Versus Unsupervised Methods, Data Mining and Its Results, The Data Mining Process, Business Understanding, Data Understanding, Data Preparation, Modeling, Evaluation, Deployment, Other Analytics Techniques and Technologies: Statistics, Database Querying, Data Warehousing, Regression Analysis, Machine Learning and Data Mining **Text Book 1: Chapter 1, Chapter 2** **RBT: L1, L2**	08
Module – 2	
Introduction to Predictive Modeling: From Correlation to Supervised Segmentation Models, Induction, and Prediction, Supervised Segmentation, Selecting Informative Attributes Example: Attribute Selection with Information Gain, Supervised Segmentation with Tree- Structured Models, Visualizing Segmentations, Trees as Sets of Rules, Probability Estimation, Example: Addressing the Churn Problem with Tree Induction. **Text Book 1: Chapter 3** **RBT: L1, L2**	08
Module – 3	
Fitting a Model to Data: Classification via Mathematical Functions: LinearDiscriminant Functions, Optimizing an Objective Function, An Example of Mining a Linear Discriminant from Data, Linear Discriminant Functions for Scoring and Ranking Instances, Support Vector Machines briefly, Regression via Mathematical Functions, Class Probability Estimation and Logistic ―Regression‖. Logistic Regression: Some Technical Details. Example: Logistic Regression versus Tree Induction, Non-Linear Functions, Support vector machines and Neural Networks OverfittingandIts Avoidance: Fundamental Concepts,ExemplaryTechniques,Regularization,Genaralization, Overfitting,Overfitting Examined **Text Book 1: Chapter 4, Chapter 5** **RBT: L1, L2, L3**	08
Module – 4	
Similarity, Neighbors, and Clusters: Similarity and Distance, Nearest-Neighbor Reasoning, Example: Whiskey Analytics, Nearest Neighbors for Predictive Modeling, How Many Neighbors and How Much Influence? Geometric Interpretation, Overfitting, and Complexity Control. Issues with Nearest-Neighbor Methods. Some important Technical Details Relating to Similarities and neighbors. Clustering, Example: Whiskey Analytics Revisited, Hierarchical Clustering, Nearest Neighbors Revisited: Clustering Around Centroids. Understanding the Results of Clustering **Text Book 1: Chapter 6** **RBT: L1, L2,L3**	08
Module – 5	
Decision Analytic Thinking I: What is a Good Model? Evaluating Classifiers Plain Accuracyand its Problems, The confusion matrix, Problems with unbalanced Classes, Problems with Unequal Costs and Benefits. **Representing and Mining Text**: Why Text Is Important? Why Text Is Difficult? Representation, Bag of Words, Term Frequency, Measuring Sparseness: Inverse Document Frequency, Combining Them: TFIDF, Example: Jazz Musicians	08

Other Data Science Tasks and Techniques: Co-occurrences and Associations: Finding Items That Go Together, Measuring Surprise: Lift and Leverage, Example: Beer and Lottery Tickets, Associations Among Facebook Likes, Profiling: Finding Typical Behavior, Link Prediction and Social Recommendation. **Text Book 1: Chapter 7, Chapter 10, Chapter 12** **RBT: L1, L2, L3**	

Course outcomes: The students should be able to:

- **Apply** the knowledge of mathematics to explain the concept of data science, the available techniques in data science and its scope in business
- **Develop** a Decision tree based on supervised segmentation and predict the class for a given data set by selecting (through solving) the attribute for segmentation using the available techniques.
- **Analyze** the given data set, and solve a problem by performing Classification using the basics of mathematics and data science
- **Develop** solutions to group entities in data set and **apply** it for the given real-world data using the basic **knowledge** of similarity, neighbors and clustering
- **Analyze** the importance of mining text (social data) and formulate the association rules based on market basket analysis

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Foster Provost and Tom Fawcett, Data Science for Business, O'Reilly, 2013

Reference Books:

1. Cathy O'Neil and Rachel Schutt, **Doing Data Science**, O'Reilly, 2014.
2. Hector Cuesta, **Practical Data Analysis**, PACKT Publishing, 2013
3. Michael R. Berthold, Christian Borgelt, Frank Hijppner Frank Klawonn, **Guide to Intelligent Data Analysis**, Springer-Verlag London Limited, 2010
4. Data Analytics using Python, Bharti Motwani, Wiley, 2020

MOBILE APPLICATION DEVELOPMENT
(OPEN ELECTIVE)
(Effective from the academic year 2018 -2019)
SEMESTER – VI

Subject Code	18CS651	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs

CREDITS –3

Course Learning Objectives: This course will enable students to:

- Learn to setup Android application development environment
- Illustrate user interfaces for interacting with apps and triggering actions
- Interpret tasks used in handling multiple activities
- Identify options to save persistent application data
- Appraise the role of security and performance in Android applications

Module – 1	**CH**
Get started, Build your first app, Activities, Testing, debugging and using support libraries **Textbook 1: Lesson 1,2,3** **RBT: L1, L2**	08
Module – 2	
User Interaction, Delightful user experience, Testing your UI **Textbook 1: Lesson 4,5,6** **RBT: L1, L2**	08
Module – 3	
Background Tasks, Triggering, scheduling and optimizing background tasks **Textbook 1: Lesson 7,8** **RBT: L1, L2**	08
Module – 4	
All about data, Preferences and Settings, Storing data using SQLite, Sharing data with content providers, Loading data using Loaders **Textbook 1: Lesson 9,10,11,12** **RBT: L1, L2**	08
Module – 5	
Permissions, Performance and Security, Firebase and AdMob, Publish// **Textbook 1: Lesson 13,14,15** **RBT: L1, L2**	08

Course outcomes: The students should be able to:

- Create, test and debug Android application by setting up Android development environment
- Implement adaptive, responsive user interfaces that work across a wide range of devices.
- Infer long running tasks and background work in Android applications
- Demonstrate methods in storing, sharing and retrieving data in Android applications
- Analyze performance of android applications and understand the role of permissions and security
- Describe the steps involved in publishing Android application to share with the world

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017. https://www.gitbook.com/book/google-developer-

training/android-developer-fundamentals-course-concepts/details (Download pdf file from the above link)
Reference Books:
1. Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd, 2014. 2. Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, O'Reilly SPD Publishers, 2015. 3. J F DiMarzio, "Beginning Android Programming with Android Studio", 4th Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126565580 4. Anubhav Pradhan, Anil V Deshpande, " Composing Mobile Apps" using Android, Wiley 2014, ISBN: 978-81-265-4660-2

INTRODUCTION TO DATA SRUCTURES AND ALGORITHM (OPEN ELECTIVE) (Effective from the academic year 2018 -2019) SEMESTER – VI			
Subject Code	18CS652	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs
CREDITS –3			

Course Learning Objectives: This course will enable students to:

- Identify different data structures in C programming language
- Appraise the use of data structures in problem solving
- Implement data structures using C programming language.

Module 1	**Contact Hours**
Introduction to C, constants, variables, data types, input output operations, operators and expressions, control statements, arrays, strings, built-in functions, user defined functions, structures, unions and pointers **Text Book 1: Chapter 1 and 2** **RBT: L1, L2**	08
Module 2	
Algorithms, Asymptotic notations, Introduction to data structures, Types of data structures, Arrays. **Text Book 1: Chapter 3 and 4** **RBT: L1, L2**	08
Module 3	
Linked lists, Stacks **Text Book 1: Chapter 5 and 6** **RBT: L1, L2**	08
Module 4	
Queues, Trees **Text Book 1: Chapter 7 and 8** **RBT: L1, L2**	08
Module 5	
Graphs, Sorting ,(selection, insertion, bubble, quick)and searching(Linear, Binary, Hash) **Text Book 1: Chapter 9 and 10** **RBT: L1, L2**	08

Course Outcomes: The student will be able to :

- Identify different data structures in C programming language
- Appraise the use of data structures in problem solving
- Implement data structures using C programming language.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Data structures using C , E Balagurusamy, McGraw Hill education (India) Pvt. Ltd, 2013.

Reference Books:

1. Ellis Horowitz and SartajSahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014.
2. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.

PROGRAMMING IN JAVA
(OPEN ELECTIVE)
(Effective from the academic year 2018 -2019)
SEMESTER – VI

Subject Code	18CS653	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs

CREDITS –3

Course Learning Objectives: This course will enable students to:

- Learn fundamental features of object oriented language and JAVA
- Set up Java JDK environment to create, debug and run simple Java programs.
- Learn object oriented concepts using programming examples.
- Study the concepts of importing of packages and exception handling mechanism.
- Discuss the String Handling examples with Object Oriented concepts

Module – 1	**CH**
An Overview of Java: Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries, Data Types, Variables, and Arrays: Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, A Few Words About Strings **Text book 1: Ch 2, Ch 3** **RBT: L1, L2**	08
Module – 2	
Operators: Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses, Control Statements: Java's Selection Statements, Iteration Statements, Jump Statements. **Text book 1: Ch 4, Ch 5** **RBT: L1, L2**	08
Module – 3	
Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize( ) Method, A Stack Class, A Closer Look at Methods and Classes: Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion, Introducing Access Control, Understanding static, Introducing final, Arrays Revisited, Inheritance: Inheritance, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class. **Text book 1: Ch 6, Ch 7.1-7.9, Ch 8.** **RBT: L1, L2**	08
Module – 4	
Packages and Interfaces: Packages, Access Protection, Importing Packages, Interfaces, Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions. **Text book 1: Ch 9, Ch 10** **RBT: L1, L2**	08
Module – 5	
Enumerations, Type Wrappers, I/O, Applets, and Other Topics: I/O Basics, Reading Console Input, Writing Console Output, The PrintWriter Class, Reading and Writing Files, Applet Fundamentals, The transient and volatile Modifiers, Using instanceof, strictfp, Native Methods, Using assert, Static Import, Invoking Overloaded Constructors Through this( ), String Handling: The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf( ), Changing the Case of Characters Within a String , Additional String Methods, StringBuffer, StringBuilder.	08

Text book 1: Ch 12.1,12.2, Ch 13, Ch 15 **RBT: L1, L2**	

Course outcomes: The students should be able to:

- Explain the object-oriented concepts and JAVA.
- Develop computer programs to solve real world problems in Java.

Develop simple GUI interfaces for a computer program to interact with users

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007. (Chapters 2, 3, 4, 5, 6,7, 8, 9,10, 12,13,15)

Reference Books:

1. Cay S Horstmann, "Core Java - Vol. 1 Fundamentals", Pearson Education, 10th Edition, 2016.
2. Raoul-Gabriel Urma, Mario Fusco, Alan Mycroft, "Java 8 in Action", Dreamtech Press/Manning Press, 1st Edition, 2014.

INTRODUCTION TO OPERATING SYSTEM (OPEN ELECTIVE) (Effective from the academic year 2018 -2019) SEMESTER – VI			
Subject Code	18CS654	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs
CREDITS –3			

Course Learning Objectives: This course will enable students to:

- Explain the fundamentals of operating system
- Comprehend multithreaded programming, process management, memory management and storage management.
- Familier with various types of operating systems

Module – 1	CH
Introduction: What OS do, Computer system organization, architecture, structure, Operations, Process, memory and storage management, Protection and security, Distributed systems, Special purpose systems, computing environments. System Structure: OS Services, User OSI, System calls, Types of system calls, System programs, OS design and implementation, OS structure, Virtual machines, OS generation, system boot **Textbook1: Chapter 1, 2** **RBT: L1, L2**	08
Module – 2	
Process Concept: Overview, Process scheduling, Operations on process, IPC, Examples in IPC, Communication in client-server systems. Multithreaded Programming: Overview, Models, Libraries, Issues, OS Examples **Textbook1: Chapter 3,4** **RBT: L1, L2**	08
Module – 3	
Process Scheduling: Basic concept, Scheduling criteria, Algorithm, multiple processor scheduling, thread scheduling, OS Examples, Algorithm Evaluation. Synchronization: Background, the critical section problem, Petersons solution, Synchronization hardware, Semaphores, Classic problems of synchronization, Monitors, Synchronization examples, Atomic transactions **Textbook1: Chapter 5, 6** **RBT: L1, L2**	08
Module – 4	
Deadlocks: System model, Deadlock characterization, Method of handling deadlock, Deadlock prevention, Avoidance, Detection, Recovery from deadlock Memory management strategies: Background, swapping, contiguous memory allocation, paging, structure of page table, segmentation, **Textbook1: Chapter 7, 8** **RBT: L1, L2**	08
Module – 5	
Virtual Memory management: Background, Demand paging, Copy-on-write, Page replacement,	08

allocation of frames, Trashing, Memory mapped files, Allocating Kernel memory, Operating system examples File system: File concept, Access methods, Directory structure, File system mounting, File sharing, protection **Textbook1: Chapter 9, 10** **RBT: L1, L2**	

Course outcomes: The students should be able to:

- Explain the fundamentals of operating system
- Comprehend process management, memory management and storage management.
- Familiar with various types of operating systems

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. A. Silberschatz, P B Galvin, G Gagne, Operating systems, 7^{th} edition, John Wiley and sons,.

Reference Books:

1. William Stalling,"Operating Systems: Internals and Design Principles", Pearson Education, 1st Edition, 2018.
2. Andrew S Tanenbaum, Herbert BOS, "Modern Operating Systems", Pearson Education, 4th Edition, 2016

MACHINE LEARNING LABORATORY (Effective from the academic year 2018 -2019) SEMESTER – VI			
Subject Code	18AIL66	**CIE Marks**	40
Number of Contact Hours/Week	0:2:2	**SEE Marks**	60
Total Number of Lab Contact Hours		**Exam Hours**	3 Hrs
Credits – 2			
Course Learning Objectives: This course will enable students to:			
• Implement and evaluate ML algorithms in Python/Java programming language.			
Descriptions (if any): 1. The programs can be implemented in either JAVA or Python. 2. Data sets can be taken from standard repository such as UCI			
Installation procedure of the required software must be demonstrated, carried out in groups and documented in the journal.			
Programs List:			

1.	Implement and demonstratethe**FIND-Salgorithm** for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file and show the output for test cases. Develop an interactive program by Compareing the result by implementing **LIST THEN ELIMINATE** algorithm.
2	For a given set of training data examples stored in a .CSV file, implement and demonstrate the **Candidate-Elimination**algorithm. Output a description of the set of all hypotheses consistent with the training examples.
3	Demonstrate Pre processing (Data Cleaning, Integration and Transformation) activity on suitable data: For example: Identify and Delete **Rows that Contain Duplicate Data** by considering an appropriate dataset. Identify and Delete **Columns That Contain a Single Value** by considering an appropriate dataset.
4	Demonstrate the working of the decision tree based **ID3 algorithm**. Use an appropriate data set for building the decision tree and apply this knowledge toclassify a new sample.
5	Demonstrate the working of the Random forest **algorithm**. Use an appropriate data set for building and apply this knowledge toclassify a new sample.
6	Implement the **naïve Bayesian classifier** for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
7	Assuming a set of documents that need to be classified, use the **naive Bayesian Classifier** model to perform this task. Calculate the accuracy, precision, and recall for your data set.
8	Construct a**Bayesian network** considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.
9	Demonstrate the working of EM algorithm to cluster a set of data stored in a .CSV file.
10	Demonstrate the working of SVM classifier for a suitable data set

Laboratory Outcomes: The student should be able to:

- Implement and demonstration of ML algorithms.
- Evaluation of different algorithms.

Conduct of Practical Examination:

- Experiment distribution
  - For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
  - For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.
- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution *(Subjected to change in accordance with university regulations)*
  - m) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
  - n) For laboratories having PART A and PART B
    - i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
    - ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

DIGITAL IMAGE PROCESSING LABORATORY WITH MINI PROJECT (Effective from the academic year 2018 -2019) SEMESTER – VI			
Subject Code	18AIL67	**CIE Marks**	40
Number of Contact Hours/Week	0:2:2	**SEE Marks**	60
Total Number of Lab Contact Hours		**Exam Hours**	03

CREDITS – 2

Course Learning Objectives: This course will enable students to:

- Demonstrate the basic skills of image process
- Demonstrate the application development skills
- Design and develop the applications of images

Descriptions (if any): --

- Programming tools preferred: SCILAB, Python, Java or any other relevant platform.
- For Part A: Students must exhibit the results and its print copy to be attached to Lab record.
- For Part B: Real Time Images can be used to demonstrate the work.
  During the practical exam: the students should demonstrate and answer Viva-Voce

Programs List:PART A

1	Write a Program to read a digital image. Split and display image into 4 quadrants, up, down, right and left
2	Write a program to showrotation, scaling, and translation of an image.
3	Read an image, first apply erosion to the image and then subtract the result from the original. Demonstrate the differencein the edge image if you use dilation instead of erosion.
4	Read an image and extract and display low-level features such as edges, textures usingfiltering techniques
5	Demonstrate enhancing and segmenting low contrast 2D images.

PART B :MINI PROJECT

Student should develop a mini project and it should be demonstratedin the laboratory examination, Some of the projects are listed and it is not limited to:

- Recognition of License Plate through Image Processing
- Recognition of Face Emotion in Real-Time
- Detection of Drowsy Driver in Real-Time
- Recognition of Handwriting by Image Processing
- Detection of Kidney Stone
- Verification of Signature
- Compression of Color Image
- Classification of Image Category
- Detection of Skin Cancer
- Marking System of Attendance using Image Processing
- Detection of Liver Tumor
- IRIS Segmentation
- Detection of Skin Disease and / or Plant Disease
- Biometric Sensing System
- Mobile Phone Camera-based Light Communications
- Modeling of Perspective Distortion within Face Images &Library for Object Tracking
- Controlling of Intelligent Traffic Light & Image Processing

- ➢ Controlling of Pests in Agriculture Field with Image Processing

(**During the practical exam: the students should demonstrate and answer Viva-Voce**)

Laboratory Outcomes: The student should be able toillustrate the following operations:

- Image Segmentation algorithm development
- Image filtering in spatial and frequency domain.
- Morphological operations in analyzing image structures

Conduct of Practical Examination:

- Experiment distribution
    - For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
    - For laboratories having PART A: Students are allowed to pick one experiment from PART A, with equal opportunity. The mini project from PART B to be run &exhibit the results also a report on the work is produced.
- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution *(Subjected to change in accordance with university regulations)*
    - o) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
    - p) For laboratories having PART A and PART B
        - i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
        - ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

MOBILE APPLICATION DEVELOPMENT LABORATORY (Effective from the academic year 2018 -2019) SEMESTER – VI			
Course Code	**18AIMP68**	**IA Marks**	40
Number of Contact Hours/Week	0:2:2	**Exam Marks**	60
Total Number of Contact Hours	3 Hours/Week	**Exam Hours**	03
CREDITS – 02			

Course Learning Objectives: This course will enable students to:

- Learn and acquire the art of AndroidProgramming.
- Configure Android studio to run theapplications.
- Understand and implement Android's User interfacefunctions.
- Create, modify and query on SQlitedatabase.
- Inspect different methods of sharing data usingservices.

Descriptions (if any):

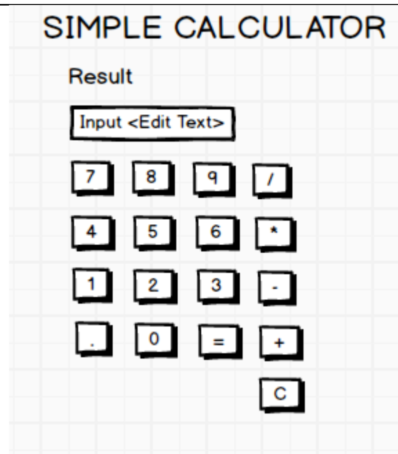
1. Installation procedure of the Android Studio/Java software must be demonstrated and carried out ingroups.
2. Students should use the latest version of Android Studio/Java/Kotlin to execute these programs. Diagrams given are for representational purpose only, students are expected to improvise on it.
3. Part B programs should be developed as an application and be demonstrated as a mini project in a group by adding extra features or the students can also develop their own application and demonstrate it as a mini project. (Projects/programs are not limited to the list given in Part B)

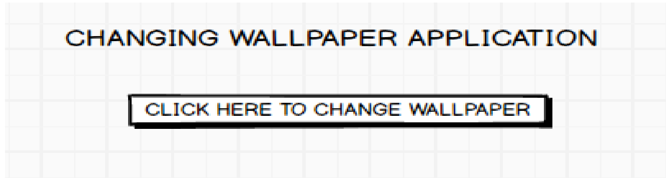
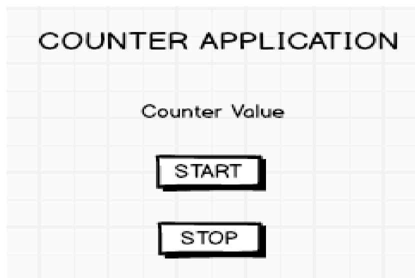
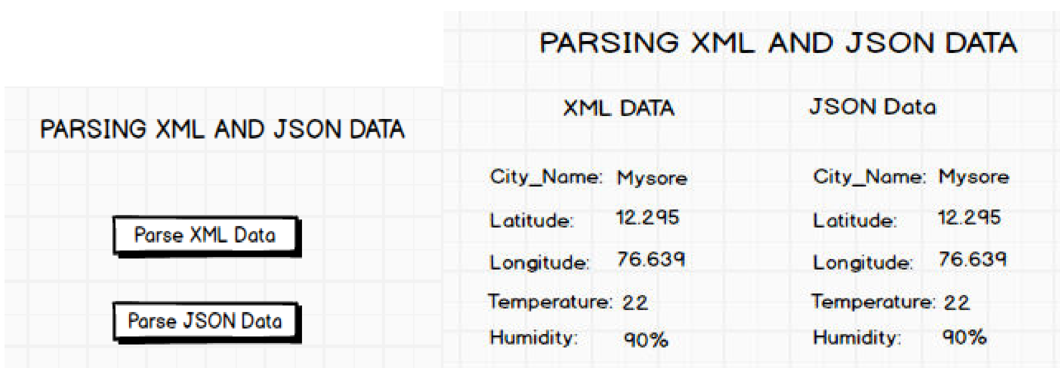
Programs List:

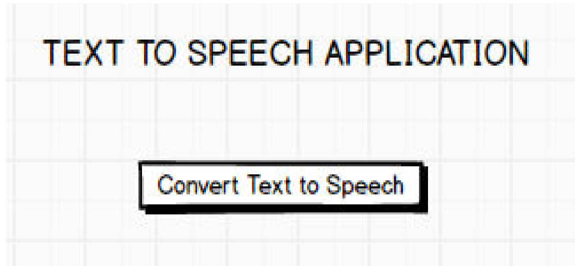
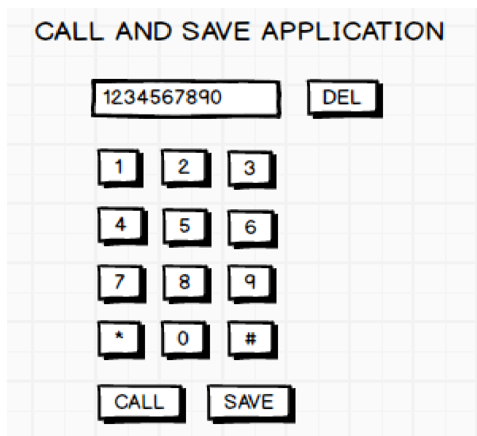
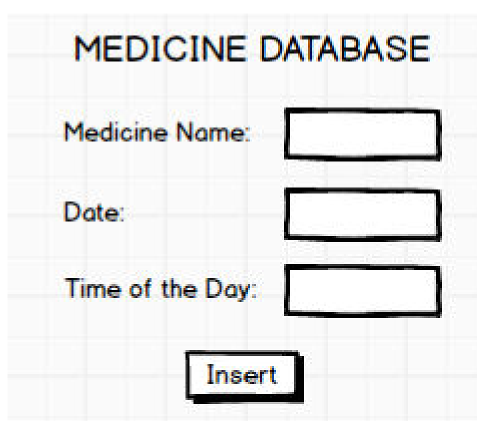
PART – A

1 Create an application to design aVisiting Card. The Visiting card should haveacompanylogoatthe top right corner. The company name should be displayed in Capital letters, aligned to the center. Information like the name of the employee, job title, phone number, address, email, fax and the website address isto be displayed. Insert a horizontal line between the job title and the phone number.

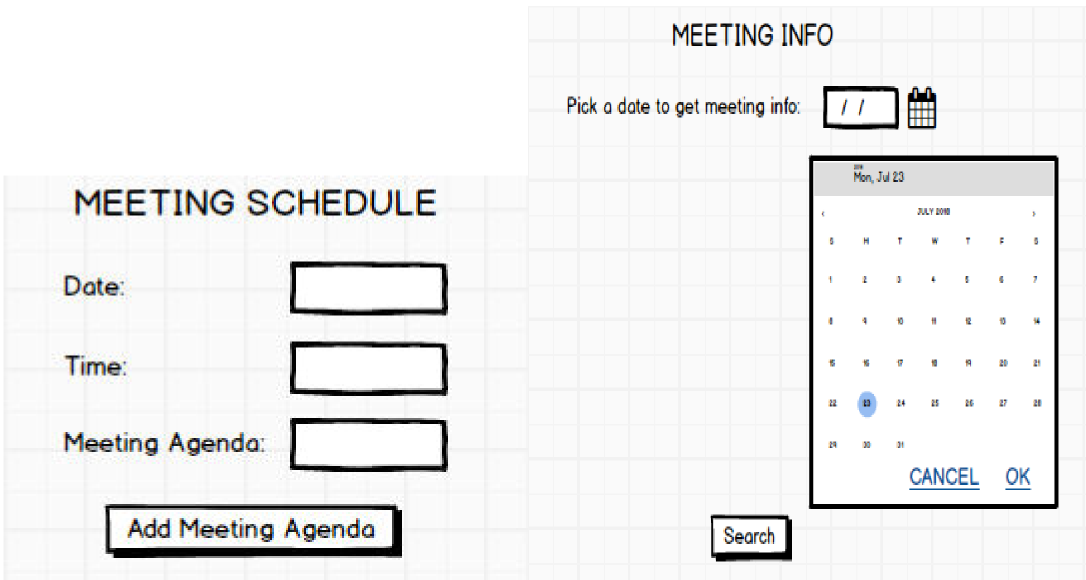
2 Develop an Android application usingcontrols like Button, TextView, EditText for designing a calculatorhaving basic functionality like Addition, Subtraction, Multiplication,andDivision.

	
3	Create a SIGN Up activity with Username and Password. Validation of password should happen based on the following rules: • Password should contain uppercase and lowercaseletters. • Password should contain letters andnumbers. • Password should contain specialcharacters. • Minimum length of the password (the default value is8). On successful **SIGN UP** proceed to the next Login activity. Here the user should **SIGN IN** using the Username and Password created during signup activity. If the Username and Password are matched then navigate to the next activity whichdisplays a message saying “Successful Login” or else display a toast message saying “Login Failed”.The user is given only two attempts and after thatdisplay a toast message saying “Failed Login Attempts” and disable the SIGN IN button. Use Bundle to transfer information from one activity to another.  

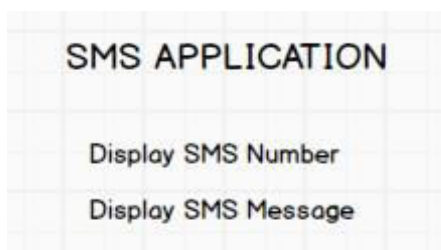
4	Develop an application to set an image as wallpaper. On click of a button, the wallpaper image should start to change randomly every 30 seconds. 
5	Write a program to create an activity with two buttons START and STOP. On pressin g of the START button, the activity must start the counter by displaying the numbers from One and the counter must keep on counting until the STOP button is pressed. Display the counter value in a TextViewcontrol. 
6	Create two files of XML and JSON type with values for City_Name, Latitude, Longitude, Temperature, and Humidity. Develop an application to create an activity with two buttons to parse the XML and JSON files which when clicked should display the data in their respective layouts side by side. 

7	Develop a simple application with one Edit Text so that the user can write some text in it. Create a button called “Convert Text to Speech” that converts the user input text into voice. 
8	Create an activity like a phone dialer with CALL and SAVE buttons. On pressing the CALL button, it must call the phone number and on pressing the SAVE button it must save the number to the phonecontacts. 
PART - B	
1	Write a program to enter Medicine Name, Date and Time of the Day as input from the user and store it in the SQLite database. Input for Time of the Day should be either Morning or Afternoon or Evening or Night. Trigger an alarm based on the Date and Time of the Day and display the Medicine Name. 

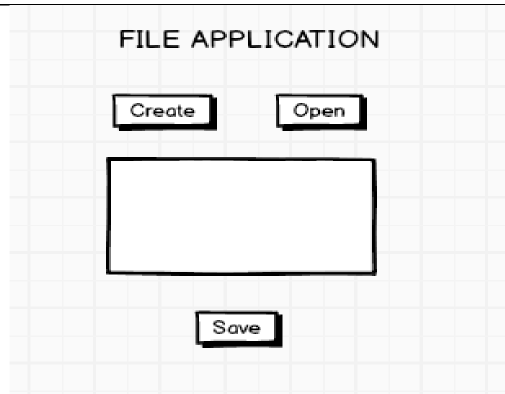
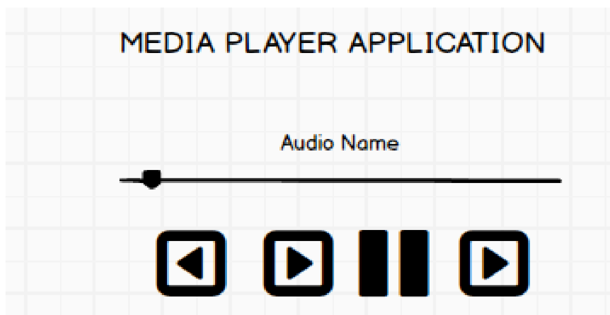
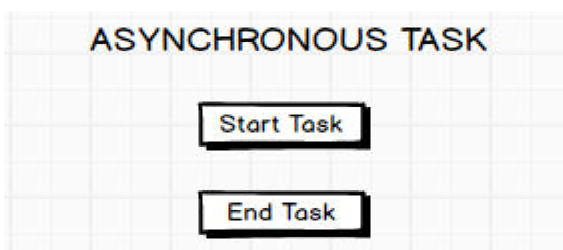
<table>
<tr>
<td>2</td>
<td>Develop a content provider application with an activity called “Meeting Schedule” which takes Date, Time and Meeting Agenda as input from the user and store this information into the SQLite database. Create another application with an activity called “Meeting Info” having DatePicker control, which on the selection of a date should display the Meeting Agenda information for that particular date, else it should display a toast message saying “No Meeting on this Date”.

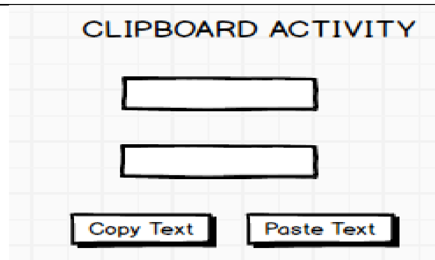


</td>
</tr>
<tr>
<td>3</td>
<td>Create an application to receive an incoming SMS which is notified to the user. On clicking this SMS notification, the message content and the number should be displayed on the screen. Use appropriate emulator control to send the SMS message to your application.



</td>
</tr>
<tr>
<td>4</td>
<td>Write a program to create an activity having a Text box, and also Save, Open and Create buttons. The user has to write some text in the Text box. On pressing the Create button the text should be saved as a text file in MkSDcard. On subsequent changes to the text, the Save button should be pressed to store the latest content to the same file. On pressing the Open button, it should display the contents from the previously stored files in the Text box. If the user tries to save the contents in the Textbox to a file without creating it, then a toast message has to be displayed saying “First Create aFile”.</td>
</tr>
</table>

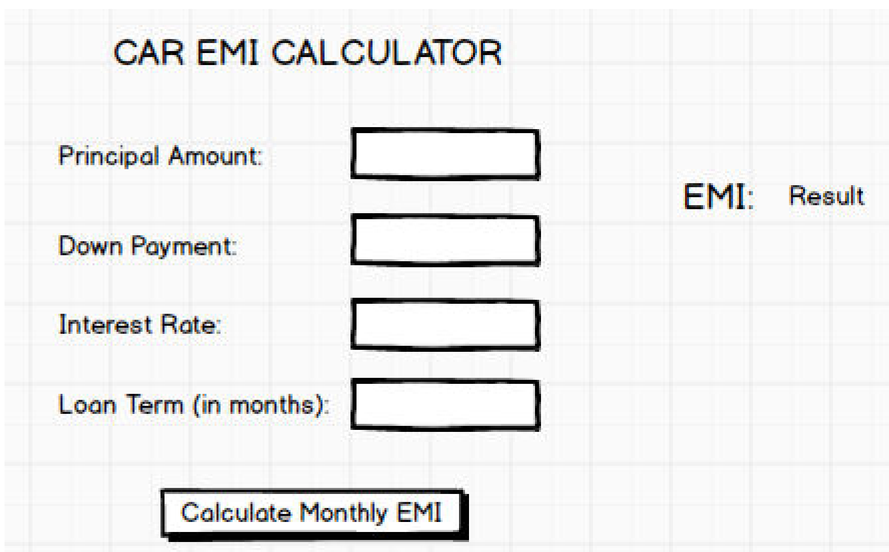
	
5	Create an application to demonstrate a basic media player that allows the user to Forward, Backward, Play and Pause an audio. Also, make use of the indicator in the seek bar to move the audio forward or backward as required. 
6	Develop an application to demonstrate the use of Asynchronous tasks in android. The asynchronous task should implement the functionality of a simple moving banner. On pressing the **Start Task** button, the banner message should scroll from right to left. On pressing the **Stop Task** button, the banner message should stop. Let the banner message be “Demonstration of Asynchronous Task”. 
7	Develop an application that makes use of the clipboard framework for copying and pasting of the text. The activity consists of two Edit Text controls and two Buttons to trigger the copy and paste functionality.

<table>
<tr><td></td><td>
</td></tr>
<tr><td>8</td><td>Create an AIDL service that calculates Car Loan EMI. The formula to calculate EMI is

$$\mathbf{E = P * (r(1+r)^n)/((1+r)^n-1)}$$

where
E = The EMI payable on the car loan amount
P = The Car loan Principal Amount
r = The interest rate value computed on a monthly basis
n = The loan tenure in the form of months

The down payment amount has to be deducted from the principal amount paid towards buying the Car. Develop an application that makes use of this AIDL service to calculate the EMI. This application should have four Edit Text to read the Principal Amount, Down Payment, Interest Rate, Loan Term (in months) and a button named as “Calculate Monthly EMI”. On click of this button, the result should be shown in a Text View. Also, calculate the EMI by varying the Loan Term and Interest Rate values.


</td></tr>
<tr><td></td><td></td></tr>
<tr><td colspan="2">Laboratory Outcomes: After studying these laboratory programs, students will be able to</td></tr>
<tr><td colspan="2">

- Create, test and debug Android application by setting up Android developmentenvironment.
- Implement adaptive, responsive user interfaces that work across a wide range ofdevices.
- Infer long running tasks and background work in Androidapplications.
- Demonstrate methods in storing, sharing and retrieving data in Androidapplications.

</td></tr>
</table>

- Infer the role of permissions and security for Androidapplications.

Procedure to Conduct Practical Examination

- **Experiment distribution**
  - **For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.**
  - **For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A with equal opportunity and in Part B demonstrate the Mini project.**
- **Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.**
- **Marks Distribution** ***(Subjected to change in accoradance with university regulations)***
  - **q) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks**
  - **r) For laboratories having PART A and PART B**
    - **i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks**
    - ii. **Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks**

Text Books:

1. Google Developer Training, **"Android Developer Fundamentals Course – Concept Reference",** Google Developer Training Team, 2017. https://www.gitbook.com/book/google-developer-training/android-developer-fundamentals-course-concepts/details
(Download pdf file from the above link)

Reference Books:

1. Erik Hellman, **"Android Programming – Pushing the Limits",** 1st Edition, Wiley India Pvt Ltd, 2014. ISBN-13: 978-8126547197
2. Dawn Griffiths and David Griffiths, **"Head First Android Development",** 1st Edition, O'Reilly SPD Publishers, 2015. ISBN-13:978-9352131341
3. Bill Phillips, Chris Stewart and Kristin Marsicano, **"Android Programming: The Big Nerd Ranch Guide",** 3rd Edition, Big Nerd Ranch Guides, 2017. ISBN-13:978-0134706054

ADVANCED ARTIFICIAL INTLLIGENCE (Effective from the academic year 2018 -2019) SEMESTER – VII			
Subject Code	18AI71	**CIE Marks**	40
Number of Contact Hours/Week	4:0:0	**SEE Marks**	60
Total Number of Contact Hours	50	**Exam Hours**	3 Hrs
CREDITS –4			

Course Learning Objectives: This course will enable students to:

- Demonstrate the fundamentals of Intelligent Agents
- Illustrate the reasoning on Uncertain Knowledge
- Explore the explanation based learning in solving AI problems
- Demonstrate the applications of Rough sets and Evolutionary Computing algorithms

Module 1	**Contact Hours**
IntelligentAgents: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents **Problem Solving :**Game Paying **T1: Chapter 2, Chapter 5 (2.1 to 2.4, 5.1 to 5.6)**	10
Module 2	
Uncertain knowledge and Reasoning: Quantifying Uncertainty**,** Acting under Uncertainty , Basic Probability Notation, Inference Using Full Joint Distributions, Independence , Bayes'Rule and Its Use The WumpusWorld Revisited, **T1: Chapter 13**	10
Module 3	
Probabilistic Reasoning, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks , Efficient Representation of Conditional Distributions Exact Inference in Bayesian Networks, Approximate Inference in Bayesian Networks. **T1: Chapter 14**	10
Module 4	
Perception: Image Formation, Early Image-Processing Operation, Object Recognition by Appearance, Reconstructing the 3DWorld. Object Recognition from Structural Information, Using Vision **T1: Chapter 24**	10
Module 5	
Overview and language modeling: Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model. **T2: Chapter 1, 2**	10

Course Outcomes: The student will be able to :

- Demonstrate the fundamentals of Intelligent Agents
- Illustrate the reasoning on Uncrtain Knowledge

- Explore the explanation based learning in solving AI problems
- Demonstrate the applications of Rough sets and Evolutionary Computing algorithms

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Artificial Intelligence, A Modern Approach, Stuart J. Russell and Peter Norvig, Third Edition, Pearson, 2010
2. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.

Reference Books:

1. An Introduction to Multi Agent Systems, Michael Wooldridge, Second Edition, John Wiley & Sons

ADVANCED MACHINE LEARNING (Effective from the academic year 2018 -2019) SEMESTER – VII			
Subject Code	18AI72	**CIE Marks**	40
Number of Contact Hours/Week	4:0:0	**SEE Marks**	60
Total Number of Contact Hours	50	**Exam Hours**	3 Hrs
CREDITS –4			

Course Learning Objectives: This course will enable students to:

- Demonstrate the fundamentals of GDT
- Illustrate the use of KNN
- Explore the Text feature Engineering concepts with Applications
- Demonstrate the use of Ensemble Methods

Module 1	**Contact Hours**
Advanced Machine Learning: Overview, Gradient Descent algorithm, Scikit-learn library for ML, Advanced Regression models, Advanced ML algorithms, KNN, ensemble methods. **T2: Chapter 6 (upto 6.5.4)** **Forecasting:**Overview, components, moving average, decomposing time series, auto-regressive Models. **T2: Chapter: 8**	10
Module 2	
Hidden Markov Model: Introduction, Issues in HMM(Evalution, decoding, learning, classifier) **T3: Chapter 12** **CLUSTERING** **Introduction,** Types of clustering, Partitioning methods of clustering (k-means, k-medoids), hierarchical methods **T3: Chapter 13**	10
Module 3	
Recommender System: Datasets, Association rules, Collaborative filtering, User-based similarity, item-based similarity, using surprise library, Matrix factorization **Text Analytics:** Overview, Sentiment Classification, Naïve Bayes model for sentiment classification, using TF-IDF vectorizer, Challenges of text analytics **T2: Chapter 9 and** 10	10
Module 4	
Neural networks and genetic algorithms: Brief history and Evolution of Neural network, Biological neuron, Basics of ANN,Activation function, MP model. **T3: Chapter 6** Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Genetic Algorithms – Hypothesis Space Search – Genetic	10

Programming – Models of Evolution and Learning. **T1: Chapter 4 & 9**	
Module 5	
Instant based learning and learning set of rules: Evaluating Hypothesis: Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms. Instance Based Learning: Introduction, k-nearest neighbor learning(review), locally weighted regression, radial basis function, cased-based reasoning, Reinforcement Learning: Introduction, Learning Task, Q Learning **T1 :Sections: 5.1-5.6, 8.1-8.5, 13.1-13.3**	10

Course Outcomes: The student will be able to :

- Apply effectively ML algorithmsto solve real world problems.
- Apply Instant based techniques and derive effectively learning rules to real world problems.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

T1. Tom M. Mitchell, Machine Learning, McGraw-Hill Education, 2013

T2. Machine Learning using Python ,Manaranjan Pradhan, U Dinesh Kumar, Wiley 2019

T3. Machine Learning, Anuradha Srinivasaraghavan, VincyJoeph, Wiley 2019

Reference Books:

1. EthemAlpaydin, Introduction to Machine Learning, PHI Learning Pvt. Ltd, 2^{nd} Ed., 2013
2. T. Hastie, R. Tibshirani, J. H. Friedman, The Elements of Statistical Learning, Springer, 1st edition, 2001
3. Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson,2020

INTERNET OF THINGS (Effective from the academic year 2018 -2019) SEMESTER – VII			
Subject Code	18AI731	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs
CREDITS –3			

Course Learning Objectives: This course will enable students to:

- Assess the genesis and impact of IoT applications, architectures in real world.
- Illustrate diverse methods of deploying smart objects and connect them to network.
- Compare different Application protocols for IoT.
- Infer the role of Data Analytics and Security in IoT.

Module 1	**Contact Hours**
What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack. **Textbook 1: Ch.1, 2** **RBT: L1, L2, L3**	08
Module 2	
Smart Objects: The “Things” in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies. **Textbook 1: Ch.3, 4** **RBT: L1, L2, L3**	08
Module 3	
IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods. **Textbook 1: Ch.5, 6** **RBT: L1, L2, L3**	08
Module 4	
Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment **Textbook 1: Ch.7, 8** **RBT: L1, L2, L3**	08
Module 5	
IoT Physical Devices and Endpoints – Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints –RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture,	08

Smart City Use-Case Examples. **Textbook 1: Ch.12** **Textbook 2: Ch.7.1 to 7.4, Ch.8.1 to 8.4, 8.6** **RBT: L1, L2, L3**	

Course Outcomes: The student will be able to :

- Interpret the impact and challenges posed by IoT networks leading to new architectural models.
- Compare and contrast the deployment of smart objects and the technologies to connect them to network.
- Appraise the role of IoT protocols for efficient network communication.
- Elaborate the need for Data Analytics and Security in IoT.
- Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,**"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things",** 1stEdition, Pearson Education (Cisco Press Indian Reprint). (**ISBN:** 978-9386873743)
2. Srinivasa K G, **"Internet of Things",**CENGAGE Leaning India, 2017

Reference Books:

1. Vijay Madisetti and ArshdeepBahga, **"Internet of Things (A Hands-on-Approach)",** 1stEdition, VPT, 2014. (**ISBN:** 978-8173719547)
2. Raj Kamal, **"Internet of Things: Architecture and Design Principles",** 1st Edition, McGraw Hill Education, 2017. (**ISBN:** 978-9352605224)

Mandatory Note:
Distribution of CIE Marks is a follows (Total 40 Marks):

- 20 Marks through IA Tests
- 20 Marks through practical assessment

Maintain a copy of the report for verification during LIC visit.

Posssible list of practicals:

1. Transmit a string using UART
2. Point-to-Point communication of two Motes over the radio frequency.
3. Multi-point to single point communication of Motes over the radio frequency.LAN (Sub-netting).
4. I2C protocol study
5. Reading Temperature and Relative Humidity value from the sensor

MULTIAGENT SYSTEMS (Effective from the academic year 2018 -2019) SEMESTER – VII			
Subject Code	18AI732	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs
CREDITS – 03			

Course Learning Objectives: This course will enable students to:

- To introduce the concept of amultiagent systems and Distributed Constraints
- To explore the main issues surrounding the 93omputer and extended form games.
- To understand learning in Multiagent Systems
- To introduce a contemporary platform for implementing agents and multiagent systems.

Module – 1	**Contact Hours**
Multiagent Problem Formulation: Utility, Markov Decision Processes, Planning **Distributed Constraints**:Distributed Constraint Satisfaction, Distributed Constraint Optimization **T1: Chapters 1 &2, T2: Chapter 1**	08
Module – 2	
Standard and Extended Form Games: Games in Normal Form, Games in Extended Form, Self-interested agents, Characteristic Form Games, Coalition Formation **T1: Chapters 3&4, T2: Chapter 3**	08
Module – 3	
Learning in Multiagent Systems: The Machine Learning Problem, Cooperative Learning, Repeated Games, Stochastic Games, General Theories for Learning Agents, Collective Intelligence **T1: Chapters 5**	08
Module – 4	
Negotiation: The Bargaining Problem, Monotonic Concession Protocol, Negotiation as Distributed Search, Ad-hoc Negotiation Strategies, The Task Allocation Problem. **Protocols for Multiagent Resource Allocation: Auctions:** Simple Auctions,Combinatorial Auctions **T1: Chapters 6&7,** **T2: Chapter 11**	08
Module – 5	
Voting and Mechanism Design: The Voting Problem, Mechanism Design. **Nature-Inspired Approaches:**Ants and Termites, Immune System **T1: Chapters 8&10,** **T2: Chapter 10**	08

Course outcomes: The students should be able to:

- Explain the concept of anmulti-agent systems and Distributed Constraints
- Explore the applications of 93omputer and extended form games.
- Understand learning in Multiagent Systems
- Introduce a contemporary platform for implementing agents and multi-agent systems.

Question Paper Pattern:

- The question paper will have ten questions.

- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Fundamentals of Multiagent Systems by Jos´e M. Vidal, 2006, available online http://jmvidal.cse.sc.edu/papers/mas.pdf
2. Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations, By YoavShoham, Kevin Leyton-Brown, Cambridge University Press, 2008, 2ndedhttp://www.masfoundations.org/mas.pdf

Reference Books:

1. Multiagent Systems : A Modern Approach to Distributed Artificial IntelligenceGerhard Weiss The MIT Press 2000

BLOCKCHAIN TECHNOLOGY (Effective from the academic year 2018 -2019) SEMESTER – VII			
Subject Code	18AI733	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs
CREDITS – 03			

Course Learning Objectives: This course will enable students to:

- Define and Explain the fundamentals of Blockchain
- Illustrate the technologies of blockchain
- Decribe the models of blockchain
- Analyze and demonstrate the Ethereum

Module – 1	**Contact Hours**
Blockchain 101: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain. **Text Book 1: Chapter 1**	08
Module-2	
Decentralization and Cryptography: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations. Cryptography and Technical Foundations: Cryptographic primitives, Asymmetric cryptography, Public and private keys **Text Book 1: Chapter 2,Chapter 4**	08
Module-3	
Bitcoin and Alternative Coins A: Bitcoin, Transactions, Blockchain, Bitcoin payments B: Alternative Coins Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash **Text Book 1: Chapter 3, Chapter 6, Chapter 8**	08
Module-4	
Smart Contracts and Ethereum 101: Smart Contracts: Definition, Ricardian contracts. Ethereum 101: Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts. **Text Book 1: Chapter 10**	08
Module-5	
Alternative Blockchains: Blockchains Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance,	08

Media **Text Book 1: Chapter 17**	

Course outcomes: The students should be able to:

- Define and Explain the fundamentals of Blockchain
- Illustrate the technologies of blockchain
- Decribe the models of blockchain
- Analyze and demonstrate the Ethereum
- Analyze and demonstrate Hyperledger fabric

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbook:

1.**Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1-78712-544-5, 2017**

Reference Books:

1. Blockchain Technology (Concepts and applications), Kumar saurabh, Ashutosh saxena, Wiley, 2020
2. Bitcoin and Cryptocurrency Technologies, Arvind Narayanan, Joseph Bonneau, Edward Felten,2016
3. Blockchain Basics: A Non-Technical Introduction in 25 Steps, Daniel Drescher, Apress, First Edition, 2017
4. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos, O'Reilly Media, First Edition, 2014

CLOUD COMPUTING AND VIRTUALIZATION
(Effective from the academic year 2018 -2019)
SEMESTER – VII

Subject Code	18AI734	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs

CREDITS –3

Course Learning Objectives: This course will enable students to:

- Interpret the data in the context of cloud computing.
- Identify an appropriate method to analyze the data in cloud enviornmnet
- Understanding of virtalization concept

Module – 1	**Contact Hours**
Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, Exercises and problems. **Textbook 1: Chapter 1 (1.3-1.6), Chapter 3 (3.1-3.5, 3.7,3.8)** RBT: L1, L2	08
Module – 2	
Cloud Computing: Application Paradigms.: Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The GreThe Web application, Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing. **Textbook 1: Chapter 4 (4.1-4.11)** RBT:L1,L2	08
Module – 3	
Cloud Resource Virtualization: Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems	08

<table>
<tr><td>Textbook 1: Chapter 5 (5.1-5.9, 5.11,5.12,5.16)

RBT:L1,L2</td><td></td></tr>
<tr><td colspan="2">Module – 4</td></tr>
<tr><td>Cloud Resource Management and Scheduling: Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling MapReduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems.

Textbook1: Chapter 6 (6.1-6.14, 6.16)

RBT : L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="2">Module – 5</td></tr>
<tr><td>Cloud Security, Cloud Application Development: Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to useS3 in java

Textbook1: Chapter 9 (9.1-9.9, 11.1-11.5)

RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="2">Course outcomes: The students should be able to:</td></tr>
<tr><td colspan="2">• Understand the concepts of cloud computing, virtualization and classify services of cloud computing
• Illustrate architecture and programming in cloud
• Define the platforms for development of cloud applications and List the application of cloud.</td></tr>
<tr><td colspan="2">Question Paper Pattern:</td></tr>
<tr><td colspan="2">• The question paper will have ten questions.
• Each full Question consisting of 20 marks
• There will be 2 full questions (with a maximum of four sub questions) from each module.
• Each full question will have sub questions covering all the topics under a module.</td></tr>
</table>

• The students will have to answer 5 full questions, selecting one full question from each module.
Text Books:
1. Cloud Computing Theory and Practice, Dan C. Marinescu, Morgan Kaufmann, Elsevier 2013.
Reference Books:
1. Mastering Cloud Computing Rajkumar Buyya, Christian Vecchiola, and ThamaraiSelvi McGraw Hill Education

FUZZY LOGIC AND ITS APPLICATION **(Effective from the academic year 2018 -2019)** **SEMESTER – VII**			
Subject Code	18AI741	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs
CREDITS – 03			
Course Learning Objectives: This course will enable students to:			
• Define crisp set and fuzzy set theory. • Identify the requirements to make calculation of fuzzy set theory. • Describe fuzzy arithmetic principles. • Explain fuzzy rules based systems. • Apply fuzzy graphical techniques to draw inference over the computing problems.			

Module – 1	**Contact Hours**
Introduction: Historical perspective, utility of fuzzy systems, limitations of fuzzy systems, statistics andrandom processes, uncertainty in information, fuzzy sets and membership, chance versus fuzziness, sets aspoints in Hypercube.**Classical Sets and Fuzzy Sets:** classical sets, operations on them, mapping of classical sets to functions, fuzzysets, fuzzy set operations, properties of fuzzy sets, non-interactive fuzzy sets. **RBT: L1, L2**	08
Module – 2	
Classical Relations and Fuzzy Relations: Cartesian Product, Crisp Relations – Cardinality of Crisp Relations,Operations on Crisp Relations, and Properties of Crisp Relations, Composition. Fuzzy Relations –Cardinalityof Fuzzy Relations, Operations on Fuzzy Relations, Properties of Fuzzy Relations, Fuzzy Cartesian Productand Composition, Non-interactive Fuzzy Sets. **RBT: L1, L2**	08
Module – 3	
Membership Functions: Features of the Membership Function, Standard Forms and Boundaries,Fuzzification, defuzzification to crisp sets, Lambda-Cuts for Fuzzy Sets, Lambda-Cuts for Fuzzy Relations,DefuzzificationMethods.Development of membership Functions: Membership value assignments **RBT: L1, L2**	08
Module – 4	
Fuzzy Arithmetic and the Extension Principle : Crisp Functions, Mapping and Relations,	08

Functions of fuzzySets – Extension Principle, Fuzzy Transform (Mapping), Practical Considerations. Fuzzy Numbers IntervalAnalysis in Arithmetic, Approximate Methods of Extension – Vertex method, DSW Algorithm, RestrictedDSW Algorithm, Comparisons. Fuzzy Vectors. **RBT: L1, L2**	
Module – 5	
Fuzzy Rule Based Systems: Natural Language, Linguistic Hedges, Rule-Based Systems – Canonical RuleForms, Decomposition of Compound Rules, Likelihood and Truth Qualification, Aggregation of Fuzzy Rules.Graphical Techniques of Inference. **RBT: L1, L2**	08

Course outcomes: The students should be able to:

- Provide basic elements of fuzzy sets.
- Differentiate between fuzzy set and classical set theory.
- Apply fuzzy membership functions to solve value assignment problems.
- Explain approximate methods of fuzzy arithmetic and extension principle.
- Discuss the applications of fuzzy rule based systems.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Fuzzy Logic with EngineeringApplicationsTimothy J. Ross Wiley IndiaInternational edition,2010 reprint

Reference Books:

1. Fuzzy Logic- Intelligence,Control, and informationJohnYenRezaLangariPearson Education 1st Edition, 2004
2. Fuzzy Sets and Fuzzy Logic-Theory and ApplicationsGeorge J. KlirBoYuanPrentice Hall of India 1st Edition, 2000
3. Fuzzy Mathematical approach to pattern Recognition, S K Pal, and D Dutta majumder , John wiley 1986
4. Neuro-fuzzy pattern recognition: methods in Soft computing, S K Pal and S Mitra
5. Fuzzy set theory and its applications by H J Zimmermann, Springer Publications

COMPUTER VISION
(Effective from the academic year 2018 -2019)
SEMESTER – VII

Subject Code	18AI742	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs

CREDITS – 03

Course Learning Objectives: This course will enable students to:

- Learn basic principles of image formation, image processing algorithms and different

algorithms for recognition from single or multiple images (video). • Understand the core vision tasks of scene understanding and recognition. • Applications to 3D modelling, video analysis, video surveillance, object recognition	
Module – 1	**Contact Hours**
Introduction and Image Formation: What is computer vision? A brief history, Geometric primitives and transformations, Photometric image formation, The digital camera. Pinhole Perspective, Weak Perspective, Cameras with Lenses, The Human Eye, Intrinsic Parameters and Extrinsic Parameters, Geometric Camera Calibration **T1: Chap 1-1.1 & 1.2, Chap 2-2.1 to 2.3. T2:Chap 1-1.1 to 1.3**	08
Module – 2	
Early Vision – One Image: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Local Image Features, Texture **T2:Chap 4-4.1 to 4.5, Chap5-5.1 to 5.5, Chap6-6.1 to 6.3, 6.5**	08
Module – 3	
Early Vision – Multiple Images: Stereopsis and Structure from Motion **T2:Chap7-7.1 to 7.7, Chap 8-8.1 to 8.3**	08
Module – 4	
Mid-level Vision: Segmentation by Clustering, Grouping and Model fitting, Tracking **T2:Chap9-9.1 to 9.4, Chap 10-10.1 to 10.7, Chap 11-11.1 to 11.3**	08
Module – 5	
High-level Vision: Registration, Smooth Surface and their Outlines, Range Data Detecting Objects in Images, Recognition **T2:Chap12-12.1 to 12.3, Chap 13-13.1 to 13.3, Chap 14-14.1 to 14.4, Chap 17-17.1 to 17.3. T1:Chap 6-6.1 to 6.6**	08
Course outcomes: The students should be able to:	
• Implement fundamental image processing techniques required for computer vision • Understand Image formation process • Perform shape analysis • Develop applications using computer vision techniques • Understand video processing and motion computation	
Question Paper Pattern:	
• The question paper will have ten questions.	

- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Computer Vision: Algorithms and Applications (CVAA), Richard Szeliski, Springer, 2nd edition, 2020, http://szeliski.org/Book/
2. Computer Vision – A modern approach, by D. Forsyth and J. Ponce, Prentice Hall, 2nd edition, 2012

Reference Books:

1. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992.
2. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.
3. Image Processing, Analysis, and Machine Vision. Sonka, Hlavac, and Boyle. Thomson.
4. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University, Press, 2012
5. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall.
6. Building Computer Vision Applications Using Artificial Neural Networks - With Step-by-step Examples in OpencvAndTensorflow With Python, Shamshad Ansari**,**Apress, 2020

SEMANTIC WEB AND SOCIAL NETWORKS

(Effective from the academic year 2018 -2019)
SEMESTER – VII

Subject Code	18AI743	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs

CREDITS – 03

Course Learning Objectives: This course will enable students to:

- To understand the components of the social network.
- To model and visualize the social network.
- To mine the users in the social network.
- To understand the evolution of the social network.
- To know the applications in real time systems.

Module – 1	**Contact Hours**
Web Intelligence: Thinking and Intelligent Web Applications, The Information Age ,The World Wide. Web, Limitations of Today's Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Berners-Lee www, Semantic Road Map,Logic on the semantic Web. **T1: Chapter 1,3,4**	08

RBT: L1, L2	
Module – 2	
Knowledge Representation for the Semantic Web: Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web –Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL), UML, XML/XML Schema. **T1: Chapter 2,5** **RBT: L1, L2**	08
Module – 3	
Ontology Engineering: Ontology Engineering, Constructing Ontology, Ontology Development Tools,Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic,Rule and Inference Engines. **T1: Chapter 7,8** **RBT: L1, L2**	08
Module – 4	
Semantic Web Applications, Services and Technology: Semantic Web applications and services,Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base ,XML Based Web Services,Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods **T1: Chapter 10,11,12** **RBT: L1, L2**	08
Module – 5	
Social Network Analysis and semantic web. What is social Networks analysis, development of the social networks analysis, Electronic Sources forNetwork Analysis – Electronic Discussion networks, Blogs and Online Communities, Web Based Networks. Building Semantic Web Applications with social network features. **T2: Chapter 2,3** **RBT: L1, L2**	08
Course outcomes: The students should be able to:	
• Work on the internal components of the social network. • Model and visualize the social network. • Analyse the behaviour of the users in the social network. • Predict the possible next outcome of the social network. • Apply social network in real time applications.	
Question Paper Pattern:	
• The question paper will have ten questions. • Each full Question consisting of 20 marks	

- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Thinking on the Web – Berners Lee, Godel and Turing, Wiley inter science, 2008.
2. Social Networks and the Semantic Web, Peter Mika, Springer, 2007.

Reference Books:

1. Semantic Web Technologies, Trends and Research in Ontology Based Systems, J. Davies, R. Studer, P. Warren, John Wiley & Sons.
2. Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publishers,(Taylor & Francis Group)
3. Information Sharing on the semantic Web – Heiner Stuckenschmidt; Frank Van Harmelen,Springer Publications.
4. Programming the Semantic Web, T. Segaran, C.Evans, J. Taylor, O'Reilly, SPD.

BUSINESS INTELLIGENCE (Effective from the academic year 2018 -2019) SEMESTER – VII			
Subject Code	18AI744	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs
CREDITS – 03			

Course Learning Objectives: This course will enable students to:

- Explain the Decision Support systems and Business Intelligence framework.
- Illustrate the significance of computerized Decision Support, and understand the mathematicalmodelling behind decision support.
- Explain Data warehousing, its architecture and Extraction, Transformation, and Load (ETL) Processes.Explore knowledge management, explain its activities, approaches and its implementation.
- Describe the Expert systems , areas suitable for application of experts system

Module – 1	**Contact Hours**
Decision Support and Business Intelligence: Opening Vignette, Changing Business Environments andComputerized Decision Support, Managerial Decision Making, Computerized Support for Decision Making, AnEarly Framework for Computerized Decision Support, The Concept of Decision Support Systems (DSS), Aframework for Business Intelligence (BI), A Work System View of Decision Support. **Text Book 1: Chapter 1** **RBT: L1, L2**	08
Module – 2	
Computerised Decision Support: Decision Making, Models, Phases of the Decision-Making Process, TheIntelligence Phase, The Design Phase, The Choice Phase, The Implementation Phase, How Decisions AreSupported.**Modelling and Analysis:**Structure of Mathematical Models for Decision Support, Certainty, Uncertainty, andRisk, Management Support Systems, Multiple Goals, Sensitivity Analysis, What-If Analysis, andGoal Seeking **Text Book 1: Chapter 2** **RBT: L1, L2**	08
Module – 3	
Data Warehousing: Data Warehousing Definitions and Concepts, Data Warehousing Process Overview, DataWarehousing Architectures, Data Integration and the Extraction, Transformation, and Load (ETL) Processes. **Text Book 1: Chapter 5** **RBT: L1, L2**	08
Module – 4	
Knowledge Management: Introduction to Knowledge Management, Organizational Learning andTransformation, Knowledge Management Activities, Approaches to Knowledge Management, InformationTechnology (IT) In Knowledge Management, Knowledge Management Systems Implementation. **Text Book 1: Chapter 11** **RBT: L1, L2**	08

Module – 5	
Expert Systems: Basic Concepts of Expert Systems, Applications of Expert Systems, Structure of ExpertSystems, Knowledge Engineering, Problem Areas Suitable for Expert Systems, Development of Expert Systems,Benefits, Limitations, and Critical Success Factors of Expert Systems. **Text Book 1: Chapter 12** **RBT: L1, L2**	08
Course outcomes: The students should be able to:	
• Apply the basics of data and business to understand Decision Support systems and Business Intelligence framework. • Describe the significance of 106omputerized Decision Support, apply the basics of mathematics to understand the mathematical modelling behind decision support. • Explain Data warehousing , its architecture and Extraction, Transformation, and Load (ETL) Processes. • Analyze the importance of knowledge management and explain its activities, approaches and its implementation. • Describe the Expert systems and analyze its development , discuss areas suitable forapplication of experts system.	
Question Paper Pattern:	
• The question paper will have ten questions. • Each full Question consisting of 20 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module.	
Textbooks:	
1. Business Intelligence and Analytics: Systems for decision support, RameshSharda,DursunDelden, Efraim Turban, Pearson Tenth edition	
Reference Books:	
1. Data Mining Techniques. ForMarketing, Sales and CustomerRelationshipManagementBerry M.&Linoff G. Wiley Publishing Inc 2004 2. Data Science for Business, Foster Provost and Tom Fawcett, O'Reilly Media,Inc2013	

INTRODUCTION TO BIG DATA ANALYTICS
(OPEN ELECTIVE)
(Effective from the academic year 2018 -2019)
SEMESTER – VII

Subject Code	18CS751	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs

CREDITS –3

Course Learning Objectives: This course will enable students to:

- Interpret the data in the context of the business.
- Identify an appropriate method to analyze the data
- Show analytical model of a system

Module – 1	Contact Hours
Introduction to Data Analytics and Decision Making: Introduction, Overview of the Book, The Methods, The Software, Modeling and Models, Graphical Models, Algebraic Models, Spreadsheet Models, Seven-Step ModelingProcess.**Describing the Distribution of a Single Variable**:Introduction,Basic Concepts, Populations and Samples, Data Sets,Variables,and Observations, Types of Data, Descriptive Measures for Categorical Variables, Descriptive Measures for Numerical Variables, Numerical Summary Measures, Numerical Summary Measures with StatTools,Charts for Numerical Variables, Time Series Data, Outliers and Missing Values,Outliers,Missing Values, Excel Tables for Filtering,Sorting,and Summarizing. **Finding Relationships among Variables**: Introduction, Relationships among Categorical Variables, Relationships among Categorical Variables and a Numerical Variable, Stacked and Unstacked Formats, Relationships among Numerical Variables, Scatterplots, Correlation and Covariance, Pivot Tables. **Textbook 1: Ch. 1,2,3** **RBT: L1, L2, L3**	08
Module – 2	
Probability and Probability Distributions:Introduction,Probability Essentials, Rule of Complements, Addition Rule, Conditional Probability and the Multiplication Rule, Probabilistic Independence, Equally Likely Events, Subjective Versus Objective Probabilities, Probability Distribution of a Single Random Variable, Summary Measures of a Probability Distribution, Conditional Mean and Variance, Introduction to Simulation. **Normal,Binormal,Poisson,and Exponential Distributions**:Introduction,The Normal Distribution, Continuous Distributions and Density Functions, The Normal Density,Standardizing:Z-Values,Normal Tables and Z-Values, Normal Calculations in Excel, Empirical Rules Revisited, Weighted Sums of Normal Random Variables, Applications of the Normal Random Distribution, The Binomial Distribution, Mean and Standard Deviation of the Binomial Distribution, The Binomial Distribution in the Context of Sampling, The Normal Approximation to the Binomial, Applications of the Binomial Distribution, The Poisson and Exponential Distributions, The Poisson Distribution, The Exponential Distribution. **Textbook 1: Ch. 4,5** **RBT: L1, L2, L3**	08

Module – 3	
Decision Making under Uncertainty:Introduction,Elements of Decision Analysis, Payoff Tables, Possible Decision Criteria, Expected Monetary Value(EMY),Sensitivity Analysis, Decision Trees, Risk Profiles, The Precision Tree Add-In,Bayes' Rule, Multistage Decision Problems and the Value of Information, The Value of Information, Risk Aversion and Expected Utility, Utility Functions, Exponential Utility, Certainty Equivalents, Is Expected Utility Maximization Used? **Sampling and Sampling Distributions**: Introduction, Sampling Terminology, Methods for Selecting Random Samples, Simple Random Sampling, Systematic Sampling, Stratified Sampling, Cluster Sampling, Multistage Sampling Schemes, Introduction to Estimation, Sources of Estimation Error, Key Terms in Sampling, Sampling Distribution of the Sample Mean, The Central Limit Theorem, Sample Size Selection, Summary of Key Ideas for Simple Random Sampling. **Textbook 1: Ch. 6,7** **RBT: L1, L2, L3**	08
Module – 4	
Confidence Interval Estimation: Introduction, Sampling Distributions, The t Distribution, Other Sampling Distributions, Confidence Interval for a Mean, Confidence Interval for a Total, Confidence Interval for a Proportion, Confidence Interval for a Standard Deviation, Confidence Interval for the Difference between Means, Independent Samples, Paired Samples, Confidence Interval for the Difference between Proportions, Sample Size Selection, Sample Size Selection for Estimation of the Mean, Sample Size Selection for Estimation of Other Parameters. **Hypothesis Testing**:Introduction,Concepts in Hypothesis Testing, Null and Alternative Hypothesis, One-Tailed Versus Two-Tailed Tests, Types of Errors, Significance Level and Rejection Region, Significance from p-values, Type II Errors and Power, Hypothesis Tests and Confidence Intervals, Practical versus Statistical Significance, Hypothesis Tests for a Population Mean, Hypothesis Tests for Other Parameters, Hypothesis Tests for a Population Proportion, Hypothesis Tests for Differences between Population Means, Hypothesis Test for Equal Population Variances, Hypothesis Tests for Difference between Population Proportions, Tests for Normality, Chi-Square Test for Independence. **Textbook 1: Ch. 8,9** **RBT: L1, L2, L3**	08
Module – 5	
Regression Analysis: Estimating Relationships: Introduction, Scatterplots : Graphing Relationships, Linear versus Nonlinear Relationships,Outliers,Unequal Variance, No Relationship,Correlations:Indications of Linear Relationships, Simple Linear Regression, Least Squares Estimation, Standard Error of Estimate, The Percentage of Variation Explained:R-Square,Multiple Regression, Interpretation of Regression Coefficients, Interpretation of Standard Error of Estimate and R-Square, Modeling Possibilities, Dummy Variables, Interaction Variables, Nonlinear Transformations, Validation of the Fit. **Regression Analysis**: Statistical Inference:Introduction,The Statistical Model, Inferences About the Regression Coefficients, Sampling Distribution of the Regression Coefficients, Hypothesis Tests for the Regression Coefficients and p-Values, A Test for the Overall Fit: The ANOVA Table,Multicollinearity,Include/Exclude Decisions, Stepwise Regression,Outliers,Violations of Regression Assumptions,Nonconstant Error Variance,Nonnormality of Residuals,Autocorrelated Residuals ,Prediction. **Textbook 1: Ch. 10,11** **RBT: L1, L2, L3**	08

Course outcomes: The students should be able to:
• Explain the importance of data and data analysis • Interpret the probabilistic models for data • Define hypothesis, uncertainty principle • Evaluate regression analysis
Question Paper Pattern:
• The question paper will have ten questions. • Each full Question consisting of 20 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module.
Text Books:
1. S C Albright and W L Winston, Business analytics: data analysis and decision making, 5/e Cenage Learning
Reference Books:
1. ArshdeepBahga, Vijay Madisetti, "Big Data Analytics: A Hands-On Approach", 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577 2. Raj Kamal and Preeti Saxena, "Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning", McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966

PYTHON APPLICATION PROGRAMMING
(OPEN ELECTIVE)
(Effective from the academic year 2018 -2019)
SEMESTER – VII

Subject Code	18CS752	**IA Marks**	40
Number of Lecture Hours/Week	3:0:0	**Exam Marks**	60
Total Number of Lecture Hours	40	**Exam Hours**	03

CREDITS – 03

Course Objectives: This course will enable students to

- Learn Syntax and Semantics and create Functions in Python.
- Handle Strings and Files in Python.
- Understand Lists, Dictionaries and Regular expressions in Python.
- Implement Object Oriented Programming concepts in Python
- Build Web Services and introduction to Network and Database Programmingin Python.

Module – 1	**Contact Hours**
Why should you learn to write programs, Variables, expressions and statements, Conditional execution, Functions **Textbook 1: Chapters 1 – 4** **RBT: L1, L2, L3**	08
Module – 2	
Iteration, Strings, Files **Textbook 1: Chapters 5– 7** **RBT: L1, L2, L3**	08
Module – 3	
Lists, Dictionaries, Tuples, Regular Expressions **Textbook 1: Chapters 8 – 11** **RBT: L1, L2, L3**	08
Module – 4	
Classes and objects, Classes and functions, Classes and methods **Textbook 2: Chapters 15 – 17** **RBT: L1, L2, L3**	08
Module – 5	
Networked programs, Using Web Services, Using databases and SQL **Textbook 1: Chapters 12– 13, 15** **RBT: L1, L2, L3**	08

Course Outcomes: After studying this course, students will be able to

- Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.
- Demonstrate proficiency in handling Strings and File Systems.
- Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
- Interpret the concepts of Object-Oriented Programming as used in Python.
- Implement exemplary applications related to Network Programming, Web Services and Databases in Python.

Question paper pattern:
• The question paper will have ten questions. • Each full Question consisting of 20 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module.
Text Books:
1. Charles R. Severance, **"Python for Everybody: Exploring Data Using Python 3",** 1st Edition, CreateSpace Independent Publishing Platform, 2016. (http://do1.dr-chuck.com/pythonlearn/EN_us/pythonlearn.pdf) 2. Allen B. Downey, **"Think Python: How to Think Like a Computer Scientist",** 2ndEdition, Green Tea Press, 2015. (http://greenteapress.com/thinkpython2/thinkpython2.pdf) (Download pdf files from the above links)
Reference Books:
1. Charles Dierbach, **"Introduction to Computer Science Using Python",**1st Edition, Wiley India Pvt Ltd, 2015. ISBN-13: 978-8126556014 2. Gowrishankar S, Veena A, **"Introduction to Python Programming",** 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372 3. Mark Lutz, **"Programming Python",**4th Edition, O'Reilly Media, 2011.ISBN-13: 978-9350232873 4. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, **"Data Structures and Algorithms in Python",**1stEdition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126562176 5. ReemaThareja, **"Python Programming Using Problem Solving Approach",** Oxford university press, 2017. ISBN-13: 978-0199480173

INTRODUCTION TO ARTIFICIAL INTELLIGENCE (OPEN ELECTIVE) (Effective from the academic year 2018 -2019) SEMESTER – VII			
Subject Code	18CS753	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs
CREDITS –3			
Course Learning Objectives: This course will enable students to:			
• Identify the problems where AI is required and the different methods available • Compare and contrast different AI techniques available. • Define and explain learning algorithms			
Module – 1			**ContactHours**
What is artificial intelligence?, Problems, Problem Spaces and search **TextBook1: Ch 1, 2** **RBT: L1, L2**			08

Module – 2	
Knowledge Representation Issues, Using Predicate Logic, Representing knowledge using Rules, **TextBoook1: Ch 4, 5 and 6.** **RBT: L1, L2**	08
Module – 3	
Symbolic Reasoning under Uncertainty, Statistical reasoning **TextBoook1: Ch 7, 8** **RBT: L1, L2**	08
Module – 4	
Game Playing, Natural Language Processing **TextBoook1: Ch 12 and 15** **RBT: L1, L2**	08
Module – 5	
Learning, Expert Systems. **TextBook1: Ch 17 and 20** **RBT: L1, L2**	08
Course outcomes: The students should be able to:	
• Identify the AI based problems • Apply techniques to solve the AI problems • Define learning and explain various learning techniques • Discuss on expert systems	
Question paper pattern:	
• The question paper will have ten questions. • Each full Question consisting of 20 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. E. Rich , K. Knight & S. B. Nair – Artificial Intelligence, 3/e, McGraw Hill.	
Reference Books:	
1. Artificial Intelligence: A Modern Approach, Stuart Rusell, Peter Norving, Pearson Education 2nd Edition. 2. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems – Prentice Hal of India. 3. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem Solving", Fourth Edition, Pearson Education, 2002. 4. Artificial Intelligence and Expert Systems Development by D W Rolston-Mc Graw hill. 5. N.P. Padhy "Artificial Intelligence and Intelligent Systems" , Oxford University Press-2015	

<table>
<tr><td colspan="4" align="center">INTRODUCTION TO DOT NET FRAMEWORK FOR APPLICATION DEVELOPMENT
(OPEN ELECTIVE)
(Effective from the academic year 2018 -2019)
SEMESTER – VII</td></tr>
<tr><td>Subject Code</td><td>18CS754</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Contact Hours/Week</td><td>3:0:0</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Contact Hours</td><td>40</td><td>Exam Hours</td><td>3 Hrs</td></tr>
<tr><td colspan="4" align="center">CREDITS –3</td></tr>
</table>

Course Learning Objectives: This course will enable students to:

- Inspect Visual Studio programming environment and toolset designed to build applications for Microsoft Windows
- Understand Object Oriented Programming concepts in C# programming language.
- Interpret Interfaces and define custom interfaces for application.
- Build custom collections and generics in C#
- Construct events and query data using query expressions

Module – 1	Contact Hours
Introducing Microsoft Visual C# and Microsoft Visual Studio 2015: Welcome to C#, Working with variables, operators and expressions, Writing methods and applying scope, Using decision statements, Using compound assignment and iteration statements, Managing errors and exceptions **T1: Chapter 1 – Chapter 6** **RBT: L1, L2**	08
Module – 2	
Understanding the C# object model: Creating and Managing classes and objects, Understanding values and references, Creating value types with enumerations and structures, Using arrays **Textbook 1: Ch 7 to 10** **RBT: L1, L2**	08
Module – 3	
Understanding parameter arrays, Working with inheritance, Creating interfaces and defining abstract classes, Using garbage collection and resource management **Textbook 1: Ch 11 to 14** **RBT: L1, L2**	08
Module – 4	
Defining Extensible Types with C#: Implementing properties to access fields, Using indexers, Introducing generics, Using collections **Textbook 1: Ch 15 to 18** **RBT: L1, L2**	08
Module – 5	
Enumerating Collections, Decoupling application logic and handling events, Querying in-memory data by using query expressions, Operator overloading **Textbook 1: Ch 19 to 22** **RBT: L1, L2**	08

Course outcomes: The students should be able to:

- Build applications on Visual Studio .NET platform by understanding the syntax and semantics of

C# • Demonstrate Object Oriented Programming concepts in C# programming language • Design custom interfaces for applications and leverage the available built-in interfaces in building complex applications. • Illustrate the use of generics and collections in C# • Compose queries to query in-memory data and define own operator behaviour
Question paper pattern:
The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.
Text Books:
1. John Sharp, Microsoft Visual C# Step by Step, 8th Edition, PHI Learning Pvt. Ltd. 2016
Reference Books:
1. Christian Nagel, "C# 6 and .NET Core 1.0", 1st Edition, Wiley India Pvt Ltd, 2016. Andrew Stellman and Jennifer Greene, "Head First C#", 3rd Edition, O'Reilly Publications, 2013. 2. Mark Michaelis, "Essential C# 6.0", 5th Edition, Pearson Education India, 2016. 3. Andrew Troelsen, "Prof C# 5.0 and the .NET 4.5 Framework", 6th Edition, Apress and Dreamtech Press, 2012.

AI AND ML APPLICATION DEVELOPMENT LABORATORY **(Effective from the academic year 2018 -2019)** **SEMESTER – VII**			
Subject Code	18AIL76	**CIE Marks**	40
Number of Contact Hours/Week	0:2:2	**SEE Marks**	60
Total Number of Lab Contact Hours		**Exam Hours**	3 Hrs
Credits – 2			
Course Learning Objectives: This course will enable students to:			
• Explore the knowledge of AI and ML concepts and practice to groom students into well-informed application developers. • Demonstrate the knowledge of human cognition, Artificial Intelligence, Machine Learning and data engineering for designing intelligent systems • Apply computational knowledge and project development skills to provide innovative solutions. • Strong practice in AI and ML programming through a variety of AI and ML problems. • Develop AI and ML applications using front-end and back-end tools			
Descriptions (if any): 1. The programs can be implemented in either JAVA or Python. 2. Data sets can be taken from standard repository			

Part A
1. Write a program to implement **k-Nearest Neighbour algorithm** to classify the iris data set. Print both correct and wrong predictions.
2. Develop a program to apply K-means algorithm to cluster a set of data stored in .CSV file. Use the same data set for clustering using **EM algorithm**. Compare the results of these two algorithms and comment on the quality of clustering.
3. Implement the non-parametric **Locally Weighted Regressionalgorithm** in order to fit data points. Select appropriate data set for your experiment and draw graphs
4. Build an Artificial Neural Network by implementing the **Backpropagation algorithm** and test the same using appropriate data sets
5. Demonstrate **Genetic algorithm** by taking a suitable data for any simple application.
6. Demonstrate **Q learning** algorithm with suitable assumption for a problem statement.
PART B **Mini Project** • Use Java, C#, PHP, Python, or any other similar front-end tool. Developed mini projectns must be demonstrated on desktop/laptop as a stand-alone or web based application • Installation procedure of the required software must be demonstrated, carried out in groups and documented in the journal. • Indicative areas include: health care, education, agriculture, banking, library, agent based systems, registration systems, industry, reservation systems, facility management, super market etc.,Similar to but not limited to: Handwritten Digit Recognition Prediction of Cardiac Arrhythmia type using Clustering and Regression Approach Hybrid Regression Technique for House Prices Prediction An Iris Recognition Algorithm for Identity Authentication An Approach to Maintain Attendance using Image Processing Techniques Unconstrained Face Recognition Vehicle Number Plate Detection System Detection of Fake News Stock Prediction using Linear Regression Prediction of Weather Report Analyzing Bike Sharing Trends Sentiment Analysis for Movie Reviews Analyzing and Recommendations of Music Trends Forecasting Stock and Commodity Prices Diabetes Prediction Speech Recognition Spam Detection using neural Networks in Python Combining satellite imagery and to predict poverty
Conduct of Practical Examination:
• Experiment distribution

- For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
- For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.

- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution *(Subjected to change in accordance with university regulations)*
  - s) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
  - t) For laboratories having PART A and PART B
    - i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
    - ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

NEURAL NETWORKS AND DEEP LEARNING
(Effective from the academic year 2018 -2019)
SEMESTER – VIII

Subject Code	18AI81	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs

CREDITS – 03

Course Learning Objectives: This course will enable students to:

- Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
- Implement deep learning algorithms and solve real-world problems.
- Execute performance metrics of Deep Learning Techniques.

Module – 1	**Contact Hours**
Introduction to ANN: Biological to Artificial neuron, Training an MLP, Training a DNN with TensorFlow , Fine tuning NN HyperParametersUp and Running with TensorFlow **Chapter 9 and 10**	08
Module-2	
Deep Neural network: Introduction, Vanishing Gradient problems, Reusing Pretrained layers, Faster optimizers, avoiding over fitting through regularization **Chapter 11**	08
Module-3	
Distributing Tensor flow across devices and servers: Multiple devices on a single machine, multiple servers, parallelizing NN on a Tensor Flow cluster **Convolution Neural Network**: Architecture of the visual cortex, Convolutional layer, Pooling layer, CNN architecture	08

Chapter 12 and 13	
Module-4	
Recurrent Neural Network: Recurrent neurons, Basic RNN in Tensor Flow, Training RNN , Deep RNNs, LSTM Cell, GRU Cell, NLP **Chapter 14**	08
Module-5	
Autoencoders: Efficient data representation, Performing PCA, Stacked autoencoders, Unsupervised pretraining using SA, Denoising, Sparse autoencoders, variational and other autoencoders. **Reinforcement Learning:** Learning to optimize rewards, policy search, Introduction to OpenAI Gym, Neural network polices, Evaluating actions, Policy gradients, Markov decision processes, TDL and Q-learning, Learning to play Ms.Pac-man using Deep Q Learning **Chapter 15 and 16**	08

Course outcomes: The students should be able to:

- Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
- Implement deep learning algorithms and solve real-world problems.
- Execute performance metrics of Deep Learning Techniques.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Hands on Machine Learning with Scikit-Learn &TensorFlow, AurelienGeron, O'Reilly, 2019

Reference Books:

1. Deep Learning Lan Good fellow and YoshuaBengio and Aaron CourvilleMIT Press2016.
2. Neural Networks and Deep Learning, Charu C. Aggarwal, Springer International Publishing, 2018

<table>
<tr><td colspan="5" align="center">SYSTEM MODELLING AND SIMULATION
(Effective from the academic year 2018 -2019)
SEMESTER – VIII</td></tr>
<tr><td>Subject Code</td><td>18AI821</td><td>CIE Marks</td><td colspan="2">40</td></tr>
<tr><td>Number of Contact Hours/Week</td><td>3:0:0</td><td>SEE Marks</td><td colspan="2">60</td></tr>
<tr><td>Total Number of Contact Hours</td><td>40</td><td>Exam Hours</td><td colspan="2">3 Hrs</td></tr>
<tr><td colspan="5" align="center">CREDITS –3</td></tr>
<tr><td colspan="5">Course Learning Objectives: This course will enable students to:</td></tr>
<tr><td colspan="5">Explain the basic system concept and definitions of system;
Discuss techniques to model and to simulate various systems;
Analyze a system and to make use of the information to improve the performance.</td></tr>
<tr><td colspan="4">Module 1</td><td>Contact Hours</td></tr>
<tr><td colspan="4">Introduction: When simulation is the appropriate tool and when it is not appropriate, Advantages and disadvantages of Simulation; Areas of application, Systems and system environment; Components of a system; Discrete and continuous systems, Model of a system; Types of Models, Discrete-Event System Simulation Simulation examples: Simulation of queuing systems. General Principles.
Textbook 1: Ch. 1, 2, 3.1.1, 3.1.3
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="4">Module 2</td><td></td></tr>
<tr><td colspan="4">Statistical Models in Simulation :Review of terminology and concepts, Useful statistical models,Discrete distributions. Continuous distributions,Poisson process, Empirical distributions.
Queuing Models:Characteristics of queuing systems,Queuingnotation,Long-run measures of performance of queuing systems,Long-run measures of performance of queuing systems cont…,Steady-state behavior of M/G/1 queue, Networks of queues,
Textbook 1: Ch. 5,6.1 to 6.3, 6.4.1,6.6
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="4">Module 3</td><td></td></tr>
<tr><td colspan="4">Random-NumberGeneration:Properties of random numbers; Generation of pseudo-random numbers, Techniques for generating random numbers,Tests for Random Numbers, Random-Variate Generation: ,Inverse transform technique Acceptance-Rejection technique.
Textbook 1: Ch. 7,8.1, 8.2
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="4">Module 4</td><td></td></tr>
<tr><td colspan="4">Input Modeling: Data Collection; Identifying the distribution with data, Parameter estimation, Goodness of Fit Tests, Fitting a non-stationary Poisson process, Selecting input models without data, Multivariate and Time-Series input models.
Estimation of Absolute Performance: Types of simulations with respect to output analysis ,Stochastic nature of output data, Measures of performance and their estimation,
Textbook 1: Ch. 9, 11.1 to 11.3
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="4">Module 5</td><td></td></tr>
<tr><td colspan="4">Measures of performance and their estimation,Output analysis for terminating simulations Continued..,Output analysis for steady-state simulations.
Verification, Calibration And Validation: Optimization: Model building, verification and validation, Verification of simulation models, Verification of simulation models,Calibration and validation of models, Optimization via Simulation.</td><td>08</td></tr>
</table>

Textbook 1: Ch. 11.4, 11.5, 10 **RBT: L1, L2, L3**	

Course Outcomes: The student will be able to :

- Explain the system concept and apply functional modeling method to model the activities of a static system
- Describe the behavior of a dynamic system and create an analogous model for a dynamic system;
- Simulate the operation of a dynamic system and make improvement according to the simulation results.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 5 th Edition, Pearson Education, 2010.

Reference Books:

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

SOFT AND EVOLUTIONARY COMPUTING (Effective from the academic year 2018 -2019) SEMESTER – VIII			
Subject Code	18AI822	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs
CREDITS – 03			

Course Learning Objectives: This course will enable students to:

- Describe the basics of Soft computing
- Explain the process Fuzzy &Genetic Algorithm to solve the optimization problem.
- Analyse the Neuro Fuzzy system for clustering and classification.
- Illustrate the process of swarm intelligence system to solve real world problems.

Module – 1	**Contact Hours**
Introduction to Soft computing: Neural networks, Fuzzy logic, Genetic algorithms, Hybrid systems and its applications. **Introduction to classical sets and fuzzy sets:** Classical relations and fuzzy relations, Membership functions. **T1: Chapter 1 and 7& 8**	08
Module – 2	
Fuzzification and Defuzzification **T1: Chapter 9 & 10**	08
Module – 3	
Genetic algorithms: Introduction, Basic operations, Traditional algorithms, Simple GA General genetic algorithms, Operators, Stopping conditions for GA flow. **T1: Chapter 15.1 To 15.10** **RBT: L1, L2**	08
Module – 4	
Swarm Intelligence System: Introduction, background of SI, Ant colony system Working of ant colony optimization, ant colony for TSP. **T2: 8.1 to 8.5** **RBT: L1, L2**	08
Module – 5	
Unit commitment problem, particle Swarm Intelligence system Artificial bee colony system, Cuckoo search system. **T2: 8.6 to 8.9** **RBT: L1, L2**	08

Course outcomes: The students should be able to:

- Implement machine learning through neural networks.
- Design Genetic Algorithm to solve the optimization problem.
- Develop a Fuzzy expert system.

- Model Neuro Fuzzy system for clustering and classification

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Principles of Soft computing, Shivanandam, Deepa S. N, Wiley India, 2011/Reprint2014
2. Soft Computing with MATLAB Programming, N. P. Padhy, S.P. Simon, Oxford, 2015.

Reference Books:

1. Neuro-fuzzy and soft computing, .S.R. Jang, C.T. Sun, E. Mizutani, Phi (EEE edition), 2012
2. Soft Computing, SarojKaushik, SunitaTiwari, McGrawHill, 2018

<table>
<tr><td colspan="4">ROBOTIC PROCESS AUTOMATION DESIGN & DEVELOPMENT
(Effective from the academic year 2018 -2019)
SEMESTER – VII</td></tr>
<tr><td>Subject Code</td><td>18AI823</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Contact Hours/Week</td><td>3:0:0</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Contact Hours</td><td>40</td><td>Exam Hours</td><td>3 Hrs</td></tr>
<tr><td colspan="4">CREDITS –3</td></tr>
<tr><td colspan="4">Course Learning Objectives: This course will enable students to:</td></tr>
<tr><td colspan="4">• To understand basic concepts of RPA
• To DescribeRPA,where it can be applied and how it is implemented
• To Describe the different types of variables,Control Flow and data manipulation techniques
• To Underst and Image,Text and DataTables Automation
• To Describe various types of Exceptions and strategies to handle</td></tr>
<tr><td colspan="3">Module – 1</td><td>Contact Hours</td></tr>
<tr><td colspan="3">RPA Foundations- What is RPA – Flavors of RPA- History of RPA- The Benefits of RPA- The downsides of RPA- RPA Compared to BPO, BPM and BPA – Consumer Willingness for Automation- The Workforce of the Future- RPA Skills-On-Premise Vs. the Cloud- Web Technology- Programming Languages and Low Code- OCR-Databases-APIs- AI-Cognitive Automation-Agile, Scrum, Kanban and Waterfall0 DevOps- Flowcharts.
Textbook 1: Ch 1, Ch 2
RBT:L1,L2</td><td>08</td></tr>
<tr><td colspan="4">Module – 2</td></tr>
<tr><td colspan="3">RPA Platforms- Components of RPA- RPA Platforms-About Ui Path- About UiPath - The future of automation - Record and Play - Downloading and installing UiPath Studio - Learning Ui Path Studio- - Task recorder - Step-by-step examples using the recorder.
Textbook 2: Ch 1, Ch 2
RBT: L1, L2</td><td>08</td></tr>
<tr><td colspan="4">Module – 3</td></tr>
<tr><td colspan="3">Sequence, Flowchart, and Control Flow-Sequencing the workflow-Activities-Control flow, various types of loops, and decision making-Step-by-step example using Sequence and Flowchart-Step-by-step example using Sequence and Control flow-Data Manipulation-Variables and Scope-Collections-Arguments – Purpose and use-Data table usage with examples-Clipboard management-File operation with step-by-step example-CSV/Excel to data table and vice versa (with a step-by-step example).
Textbook 2: Ch 3, Ch 4
RBT:L1,L2</td><td>08</td></tr>
<tr><td colspan="4">Module – 4</td></tr>
<tr><td colspan="3">Taking Control of the Controls- Finding and attaching windows- Finding the control-Techniques for waiting for a control- Act on controls – mouse and keyboard activities-Working with UiExplorer- Handling events- Revisit recorder- Screen Scraping- When to use OCR- Types of OCR available- How to use OCR- Avoiding typical failure points.
Text book 2: Ch 5
RBT:L1,L2</td><td>08</td></tr>
<tr><td colspan="4">Module – 5</td></tr>
</table>

Exception Handling, Debugging, and Logging- Exception handling- Common exceptions and ways to handle them- Logging and taking screenshots- Debugging techniques- Collecting crash dumps- Error reporting- Future of RPA **Text book 2: Ch 8** **Text book 1: Ch 13** **RBT:L1,L2**	08

Course outcomes: The students should be able to:

- ToUnderstand the basicconcepts of RPA
- To Describe various components and platforms of RPA
- To Describe the different types of variables,control flow and data manipulation techniques
- To Understand various control techniques and OCR in RPA
- To Describe varioustypes and strategies to handle exceptions

Question paper pattern:

- The question paper will have ten questions.
- There will be 2 questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Tom Taulli , The Robotic Process Automation Handbook : A Guide to Implementing RPA Systems,2020, ISBN-13 (electronic): 978-1-4842-5729-6, Publisher : Apress
2. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher:Packt Publishing Release Date: March 2018 ISBN:9781788470940

Reference Books:

1. Frank Casale,Rebecca Dilla,Heidi Jaynes,Lauren Livingston,"Introductionto Robotic Process Automation :A Primer",Institute of Robotic Process Automation.
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots,Automate Repetitive Tasks& Become An RPA Consultant
3. Srikanth Merianda,Robotic Process Automation Tools,Process Automation and their benefits:Understanding RPA and Intelligent Automation

https://www.uipath.com/rpa/robotic-process-automation

MODERN INFORMATION RETRIEVAL (Effective from the academic year 2018 -2019) SEMESTER – VIII			
Subject Code	18AI824	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs
CREDITS – 03			

Course Learning Objectives: This course will enable students to:

- To learn the classical techniques of Information Retrieval and extract meaningful patterns from it.
- To get an insight into practical algorithms of textual document indexing, relevant ranking, web mining, text analytics and their performance evaluations.
- To acquire the necessary experience to design, and implement applications using Information Retrieval systems

Module – 1	Contact Hours
Introduction: Basic Concepts – Retrieval Process – Modeling – Classic Information Retrieval – Set Theoretic, Algebraic and Probabilistic Models. **Text Book 1: Chapter 1, Chapter 2**	08
Module – 2	
Retrieval Techniques: Structured Text Retrieval Models –Retrieval Evaluation – Word Sense Disambiguation. **Text Book 1: Chapter 3**	08
Module – 3	
Querying: Languages – Key Word based Querying – Pattern Matching – Structural Queries – Query Operations – User Relevance Feedback – Local and Global Analysis **Text Book 1: Chapter 4, Chapter 5**	08
Module – 4	
Text Operations: Document Pre-processing – Clustering – Text Compression - Indexing and Searching – Inverted files – Boolean Queries – Sequential searching – Pattern matching. **Text Book 1: Chapter 7, Chapter 8**	08
Module – 5	
User Interface&Applications: User Interface and Visualization – Human Computer Interaction – Access Process – Starting Points – Query Specification - Context – User relevance Judgment – Interface for Search. Searching the Web – Challenges – Characterizing the Web – Search Engines – Browsing – Metasearchers – Online IR systems – Online Public Access Catalogs. **Text Book 1: Chapter 10, Chapter 13, Chapter 14**	08

Course outcomes: The students should be able to:

- Apply information retrieval principles to locate relevant information in large collections of data
- Implement features of retrieval systems for web-based search tasks.
- Apply the common algorithms and techniques for information retrieval related to document indexing and query processing
- Demonstrate a thorough understanding and solid knowledge of the principles and techniques of

human-computer interaction

- Implement graphical user interfaces with modern software tools
- Develop and design interactive software systems applications for real time applications
- Design and develop web applications for the effective informational retrieval

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Ricardo Baeza-Yate, Berthier Ribeiro-Neto, Modern Information Retrieval, Pearson Education Asia, 2012.

Reference Books:

1. G.G. Chowdhury, Introduction to Modern Information Retrieval, Second Edition, Neal- Schuman Publishers, 2010.

"Jnana Gangotri" Campus, #873/2, Ballari-Hosapete Road,
Near Allipura, Ballari-583 104 (Karnataka)

CIVIL ENGINEERING STREAM

1st / 2nd Semester Scheme and Syllabus
(Effective from the academic year 2022-23)

Scheme of Teaching and Examinations-2022

Outcome-Based Education (OBE) and Choice Based Credit System (CBCS) (Effective from the academic year 2022-23)

I Semester (Civil Engineering Stream) (Physic Group)

SN	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	*ASC(IC)	** 22MATC11	Mathematics for Civil Engg stream-I	Maths	2	2	2	0	03	50	50	100	04
2	#ASC(IC)	22PHYC12	Physics for Civil Engg Stream	PHY	2	2	2	0	03	50	50	100	04
3	ESC	22CIV13	Engineering Mechanics	Civil Engineering Dept.	2	2	0	0	03	50	50	100	03
4	ESC-I	22ESC14x	Engineering Science Course-I	Respective Engg Dept.	3	0	0	0	03	50	50	100	03
5	ETC-I	22ETC15x	Emerging Technology Course-I	Any Dept.	3	0	0	0	03	50	50	100	03
	OR												
	PLC-I	22PLC15x	Programming Language Course-I		2	0	2	0	03				
6	AEC	22ENG16	Communicative English	Humanities	1	0	0	0	01	50	50	100	01
7	HSMC	22KSK17/ 22KBK17	Samskrutika Kannada/ Balake Kannada	Humanities	1	0	0	0	01	50	50	100	01
		OR											
		22ICO17	Indian Constitution										
8	AEC/SDC	22IDT18	Innovation and Design Thinking	Any Dept.	1	0	0	0	01	50	50	100	01
		OR			OR								
		22SFH18	Scientific Foundations of Health		1	0	0	0	01				
				TOTAL						**400**	**400**	**800**	**20**

SDA-Skill Development Activities, **TD/PSB**- Teaching Department / Paper Setting Board, **ASC**-Applied Science Course, **ESC**- Engineering Science Courses, **ETC**- Emerging Technology Course, **AEC**- Ability Enhancement Course, HSMS-Humanity and Social Science and management Course, SDC- Skill Development Course, **CIE** –Continuous Internal Evaluation, **SEE**- Semester End Examination, **IC** – Integrated Course (Theory Course Integrated with Practical Course)

Credit Definition:
1-hour Lecture (L) per week=**1Credit**
2-hoursTutorial(T) per week=**1Credit**
2-hours Practical / Drawing (P) per week=**1Credit**
2-hous Skill Development Actives (SDA) per week = **1 Credit**

04-Credits courses are to be designed for 50 hours of Teaching-Learning Session 04-Credits (IC) are to be designed for 40 hours' theory and 12-14 hours of practical sessions
03-Credits courses are to be designed for 40 hours of Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 12-15 hours of Teaching-Learning sessions

Student's Induction Program: Motivating (Inspiring) Activities under the Induction program – The main aim of the induction program is to provide newly admitted students a broad understanding of society, relationships, and values. Along with the knowledge and skill of his/her study, students' character needs to be nurtured as an essential quality by which he/she would understand and fulfill the responsibility as an engineer. The following activities are to be covered in 21 days. Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to Local areas, Familiarization with Department/Branch and Innovation, etc. For details, refer the ANNEXUREI of Induction Programs notification of the University published at the beginning of the 1st semester.

AICTE Activity Points to be earned by students admitted to BE/ B.Tech., / B. Plan day college program (For more details refer to Chapter 6, AICTE Activity Point Program, Model Internship Guidelines): Over and above the academic grades, every regular student admitted to the 4 years Degree program and every student entering 4 years Degree programs through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Program. Students transferred from other Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, any time during the semester weekends, and holidays, as per the liking and convenience of the student from the year of entry to the program. However, the minimum hour's requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, an Eighth Semester Grade Card shall be issued only after earning the required activity points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

-22MATC11** Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory question papers * The mathematics subject should be taught by a single faculty member per division, with no sharing of the course(subject)module-wise by different faculty members.**
#-22PHYC12 SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination
ESC or ETC of 03 Credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature of the course required practical learning then the syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0).
All 01 Credit- courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

(ESC-I) Engineering Science Courses-I					(ETC-I) Emerging Technology Courses-I				
Code	**Title**	**L**	**T**	**P**	**Code**	**Title**	**L**	**T**	**P**
22ESC141	Introduction to Civil Engineering	3	0	0	22ETC15A	Smart materials and Systems	3	0	0
22ESC142	Introduction to Electrical Engineering	3	0	0	22ETC15B	Green Buildings	3	0	0
22ESC143	Introduction to Electronics Engineering	3	0	0	22ETC15E	Renewable Energy Sources	3	0	0
22ESC144	Introduction to Mechanical Engineering	3	0	0	22ETC15F	Drone technology	3	0	0
22ESC145	Introduction to C Programming	2	0	2	22ETC15G	Introduction to Sustainable Engineering	3	0	0
					22ETC15H	Introduction to Internet of Things(IoT)	3	0	0
					22ETC15I	Waste Management	3	0	0
					22ETC15J	Introduction to Cyber Security	3	0	0
(PLC-I) Programming Language Courses-I									
Code	**Title**	**L**	**T**	**P**					
22PLC15A	Introduction to Web Programming	2	0	2					
22PLC15B	Introduction to Python Programming	2	0	2					
22PLC15C	Basics of JAVA programming	2	0	2					
22PLC15D	Introduction to C++ Programming	2	0	2					
The course 22ESC145/245, Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT									

- The student has to select one course from the ESC-I group.
- Civil Engineering Students shall opt for any one of the courses from the ESC-I group except, 22ESC141-Introduction to Civil Engineering
- The students have to opt for the courses from ESC group without repeating the course either 1st or 2nd semester
- The students must select one course from either ETC-I or PLC-I group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

Scheme of Teaching and Examinations-2022

Outcome-Based Education (OBE) and Choice Based Credit System (CBCS) (Effective from the academic year 2022-23)
II Semester (Civil Engineering Stream) (for students who attended I semester under Physics Group)

SN	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	*ASC(IC)	**22MATC21	Mathematics for Civil Engg Stream-II	Maths	2	2	2	0	03	50	50	100	04
2	#ASC(IC)	22CHEC22	Chemistry for Civil Engg Stream	Chemistry	2	2	2	0	03	50	50	100	04
3	ESC	22CED23	Computer-Aided Engineering Drawing	Civil / Mech. Engg Dept.	2	0	2	0	03	50	50	100	03
4	ESC-II	22ESC24x	Engineering Science Course-II	Respective Engg Dept.	3	0	0	0	03	50	50	100	03
5	PLC-II	22PLC25x	Programming Language Course-II	Any. Dept.	2	0	2	0	03	50	50	100	03
	OR												
	ETC-II	22ETC25x	Emerging Technology Course-II		3	0	0	0	03				
6	AEC	22PWS26	Professional Writing Skills in English	Humanities	1	0	0	0	01	50	50	100	01
7	HSMS	22ICO27	Indian Constitution	Humanities	1	0	0	0	01	50	50	100	01
		OR											
		22KSK27 22KBK27	Samskrutika Kannada/ Balake Kannada										
8	HSMS	22SFH28	Scientific Foundations of Health	Any Dept.	1	0	0	0	01	50	50	100	01
	OR				OR								
	HSMS	22ITD29	Innovation and Design Thinking	Any	1	0	0	0	01	50	50	100	
TOTAL										400	400	800	20

SDA-Skill Development Activities, TD/PSB- Teaching Department / Paper Setting Board, ASC-Applied Science Course, ESC- Engineering Science Courses, ETC- Emerging Technology Course, AEC- Ability Enhancement Course, HSMS-Humanity and Social Science and management Course, SDC- Skill Development Course,
CIE -Continuous Internal Evaluation, SEE- Semester End Examination, IC – Integrated Course (Theory Course Integrated with Practical Course)

Credit Definition: 1-hour Lecture (L) per week=1Credit 2-hoursTutorial(T) per week=1Credit 2-hours Practical / Drawing (P) per week=1Credit 2-hous Skill Development Actives (SDA) per week = 1 Credit	04-Credits courses are to be designed for 50 hours of Teaching-Learning Session 04-Credits (IC) are to be designed for 40 hours' theory and 12-14 hours of practical sessions 03-Credits courses are to be designed for 40 hours of Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 12-15 hours of Teaching-Learning sessions

***-22MAT21** Shall have the 03 hours of theory examination (SEE), however, practical sessions question shall be included in the theory question papers. ** The mathematics subject should be taught by single faculty member per division, with no sharing of the course (subject) module-wise by different faculty members.
#-22CHE22- SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination
ESC or ETC of 03 credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required practical learning syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0).
All 01 Credit- courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

(ESC-II) Engineering Science Courses-II					(ETC-II) Emerging Technology Courses-II				
Code	Title	L	T	P	Code	Title	L	T	P
22ESC241	Introduction to Civil Engineering	3	0	0	22ETC25A	Smart materials and Systems	3	0	0
22ESC242	Introduction to Electrical Engineering	3	0	0	22ETC25B	Green Buildings	3	0	0
22ESC243	Introduction to Electronics Engineering	3	0	0	22ETC25E	Renewable Energy Sources	3	0	0
22ESC244	Introduction to Mechanical Engineering	3	0	0	22ETC25F	Drone technology	3	0	0
22ESC245	Introduction to C Programming	2	0	2	22ETC25G	Introduction to Sustainable Engineering	3	0	0
					22ETC25H	Introduction to Internet of Things(IoT)	3	0	0
					22ETC25I	Waste Management	3	0	0

					22ETC25J	Introduction to Cyber Security	3	0	0
(PLC-II) Programming Language Courses-II									
Code	**Title**	**L**	**T**	**P**					
22PLC25A	Introduction to Web Programming	2	0	2					
22PLC25B	Introduction to Python Programming	2	0	2					
22PLC25C	Basics of JAVA programming	2	0	2					
22PLC25D	Introduction to C++ Programming	2	0	2					
The course 22ESC145/245, Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT									

- The student has to select one course from the ESC-II group.
- Civil Engineering Students shall opt for any one of the courses from the ESC-II group except, 22ESC241-**Introduction to Civil Engineering**
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-II or PLC-II group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

Scheme of Teaching and Examinations-2022

Outcome-Based Education (OBE) and Choice Based Credit System (CBCS) (Effective from the academic year 2022-23)
I Semester (Civil Engineering Stream) (Chemistry Group)

SN	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	*ASC(IC)	**22MATC11	Mathematics for Civil Engg Stream-I	Maths	2	2	2	0	03	50	50	100	04
2	#ASC(IC)	22CHEC12	Chemistry for Civil Engg Stream-I	Chemistry	2	2	2	0	03	50	50	100	04
3	ESC	22CED13	Computer-Aided Engineering Drawing	Civil/Mech. Engg Dept.	2	0	2	0	03	50	50	100	03
4	ESC-I	22ESC14x	Engineering Science Course-I	Respective Dept.	3	0	0	0	03	50	50	100	03
5	ETC-I	22ETC15x	Emerging Technology Course-I	Any Dept.	3	0	0	0	03	50	50	100	03
	OR												
	PLC-I	22PLC15x	Programming Language Course-I		2	0	2	0	03				
6	AEC	22ENG16	Communicative English	Humanities	1	0	0	0	01	50	50	100	01
7	HSMS	22ICO17	Indian Constitution	Humanities	1	0	0	0	01	50	50	100	01
		OR											
		22KSK17/ 22KBK17	Samskrutika Kannada/ Balake Kannada										
8	HSMS	22SFH18	Scientific Foundations of Health	Any Dept.	1	0	0	0	01	50	50	100	01
	OR												
	HSMS	22ITD18	Innovation and Design Thinking	Any Dept.	1	0	0	0	01				
			TOTAL		**15**	**06**	**10**	**00**	**27**	**400**	**400**	**800**	**20**

SDA-Skill Development Activities, TD/PSB- Teaching Department / Paper Setting Board, ASC-Applied Science Course, ESC- Engineering Science Courses, **ETC-** Emerging Technology Course, AEC- Ability Enhancement Course, HSMS-Humanity and Social Science and management Course, **SDC-** Skill Development Course,

CIE -Continuous Internal Evaluation, SEE- Semester End Examination, IC – Integrated Course (Theory Course Integrated with Practical Course)

***22MAT11** Shall have the 03 hours of theory examination (SEE), however, practical sessions question shall be included in the theory question papers. ** The mathematics subject should be taught by single faculty member per division, with no sharing of the course (subject) module-wise by different faculty members.
#-22CHEC12- SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination
ESC or ETC of 03 credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required practical learning syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0).
All 01 Credit- courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

Credit Definition:	
1-hour Lecture (L) per week=1Credit 2-hoursTutorial(T) per week=1Credit 2-hours Practical / Drawing (P) per week=1Credit 2-hous Skill Development Actives (SDA) per week = 1 Credit	04-Credits courses are to be designed for 50 hours of Teaching-Learning Session 04-Credits (IC) are to be designed for 40 hours' theory and 12-14 hours of practical sessions 03-Credits courses are to be designed for 40 hours of Teaching-Learning Session 02-Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 12-15 hours of Teaching-Learning sessions

Student's Induction Program: Motivating (Inspiring) Activities under the Induction program – The main aim of the induction program is to provide newly admitted students a broad understanding of society, relationships, and values. Along with the knowledge and skill of his/her study, students' character needs to be nurtured as an essential quality by which he/she would understand and fulfil the responsibility as an engineer. The following activities are to be covered in 21 days. Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to Local areas, Familiarization with Department/Branch and Innovation, etc. For details, refer the ANNEXUREI of Induction Programs notification of the University published at the beginning of the 1st semester.

AICTE Activity Points to be earned by students admitted to BE/ B.Tech., / B. Plan day college program (For more details refer to Chapter 6, AICTE Activity Point Program, Model Internship Guidelines): Over and above the academic grades, every regular student admitted to the 4 years Degree program and every student entering 4 years Degree programs through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Program. Students transferred from other Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, any time during the semester weekends, and holidays, as per the liking and convenience of the student from the year of entry to the program. However, the minimum hour's requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, an Eighth Semester

Grade Card shall be issued only after earning the required activity points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

(ESC-I) Engineering Science Courses-I					(ETC-I) Emerging Technology Courses-I				
Code	**Title**	**L**	**T**	**P**	**Code**	**Title**	**L**	**T**	**P**
22ESC141	Introduction to Civil Engineering	3	0	0	22ETC15A	Smart materials and Systems	3	0	0
22ESC142	Introduction to Electrical Engineering	3	0	0	22ETC15B	Green Buildings	3	0	0
22ESC143	Introduction to Electronics Engineering	3	0	0	22ETC15E	Renewable Energy Sources	3	0	0
22ESC144	Introduction to Mechanical Engineering	3	0	0	22ETC15F	Drone technology	3	0	0
22ESC145	Introduction to C Programming	2	0	2	22ETC15G	Introduction to Sustainable Engineering	3	0	0
					22ETC15H	Introduction to Internet of Things(IoT)	3	0	0
					22ETC15I	Waste Management	3	0	0
					22ETC15J	Introduction to Cyber Security	3	0	0
							3	0	0
(PLC-I) Programming Language Courses-I									
Code	**Title**	**L**	**T**	**P**					
22PLC15A	Introduction to Web Programming	2	0	2					
22PLC15B	Introduction to Python Programming	2	0	2					
22PLC15C	Basics of JAVA programming	2	0	2					
22PLC15D	Introduction to C++ Programming	2	0	2					

The course 22ESC145/245, Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT

- The student has to select one course from the ESC-I group.
- Civil Engineering Students shall opt for any one of the courses from the ESC-I group except, 22ESC141-Introduction to Civil Engineering
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-I or PLC-I group.
- If students study the subject from ETC-I in 1st semester he / she has to select the course from PLC-II in the 2nd semester and vice-versa

Scheme of Teaching and Examinations-2022

Outcome-Based Education (OBE) and Choice Based Credit System (CBCS) (Effective from the academic year 2022-23)
II Semester (Civil Engineering Stream) (For the students who attended I semester under Chemistry Group)

Sl. No	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	*ASC (IC)	**22MATC21	Mathematics for Civil Engineering-II	Maths	2	2	2	0	03	50	50	100	04
2	#ASC (IC)	22PHYC22	Physics for Civil Engineering	PHY	2	2	2	0	03	50	50	100	04
3	ESC	22CIV23	Engineering Mechanics	Civil Engineering Dept.	2	2	0	0	03	50	50	100	03
4	ESC-II	22ESC24x	Engineering Science Course-II	Respective Engg Dept.	3	0	0	0	03	50	50	100	03
5	PLC-II	22PLC25x	Programming Language Course-II	Any Dept.	2	0	2	0	03	50	50	100	03
	OR												
	ETC-II	22ETC25x	Emerging Technology Course-II		3	0	0	0	03				
6	AEC	22PWS26	Professional Writing Skills in English	Humanities	1	0	0	0	01	50	50	100	01
7	HSMC	22KSK27 22KBK27	Samskrutika Kannada/ Balake Kannada	Humanities	1	0	0	0	01	50	50	100	01
		OR											
		22ICO27	Indian Constitution										
8	AEC/SDC	22IDT28	Innovation and Design Thinking	Any Dept.	1	0	0	0	01	50	50	100	01
		OR											
		22SFH28	Scientific Foundations of Health		1	0	0	0					
TOTAL										**400**	**400**	**800**	**20**

SDA-Skill Development Activities, TD/PSB- Teaching Department / Paper Setting Board, ASC-Applied Science Course, ESC- Engineering Science Courses, ETC- Emerging Technology Course, AEC- Ability Enhancement Course, HSMS-Humanity and Social Science and management Course, SDC- Skill Development Course,
CIE –Continuous Internal Evaluation, SEE- Semester End Examination, IC – Integrated Course (Theory Course Integrated with Practical Course)

-22MATC21** shall have the 03 hours of theory examination (SEE), however, practical sessions question shall be included in the theory question papers. * The mathematics subject should be taught by single faculty member per division, with no sharing of the course (subject) module-wise by different faculty members.**
#-22PHYC22 SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination
ESC or ETC of 03 credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required experimental learning then the syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0). However, there is no SEE for the practical component.
All 01 Credit- courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

(ESC-II) Engineering Science Courses-II

Code	Title	L	T	P
22ESC241	Introduction to Civil Engineering	3	0	0
22ESC242	Introduction to Electrical Engineering	3	0	0
22ESC243	Introduction to Electronics Engineering	3	0	0
22ESC244	Introduction to Mechanical Engineering	3	0	0
22ESC245	Introduction to C Programming	2	0	2

(ETC-II) Emerging Technology Courses-II

Code	Title	L	T	P
22ETC25A	Smart materials and Systems	3	0	0
22ETC25B	Green Buildings	3	0	0
22ETC25E	Renewable Energy Sources	3	0	0
22ETC25F	Drone technology	3	0	0
22ETC25G	Introduction to Sustainable Engineering	3	0	0
22ETC25H	Introduction to Internet of Things(IoT)	3	0	0
22ETC25I	Waste Management	3	0	0
22ETC25J	Introduction to Cyber Security	3	0	0

(PLC-II) Programming Language Courses-II

Code	Title	L	T	P
22PLC25A	Introduction to Web Programming	2	0	2
22PLC25B	Introduction to Python Programming	2	0	2
22PLC25C	Basics of JAVA programming	2	0	2
22PLC25D	Introduction to C++ Programming	2	0	2

The course 22ESC145/245, Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT

- The student has to select one course from the ESC-II group.
- Civil Engineering Students shall opt for any one of the courses from the ESC-II group except, 22ESC241- Introduction to Civil Engineering
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-II or PLC-II group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

Semester: I
Course Title: Mathematics for CIVIL Stream-I

Course Code:	**22MATC11**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:2:2:0	Exam Hours	03+02
Total Hours of Pedagogy	40 hours Theory + 10-12 Lab Slots	Credits	04

PRE REQUISITES

Matrices and Determinants.
Differentiation basic formulae, differentiation of a function of a function
Differentiation basic formulae, differentiation of a function of a function
Definition of Differential Equations, Formation of Differential equations, order and degree of a differential equations. Basic formulae of Integration.
Basic formulae of Integration and evaluation of Definite Integrals

Module-1 Linear Algebra	**8 hours**
Elementary row transformation of a matrix, Rank of a matrix. Consistency and Solution of system of linear equations - Gauss-Elimination method, Gauss-Jordan method and approximate solution by Gauss-Seidel method. Rayleigh's power method to find the dominant Eigen value and the corresponding Eigenvector. Problems **Self-Study:** Diagonalization of a square matrix of order 2, Solution of system of equations by Gauss-Jacobi iterative method, Inverse of a square matrix by Cayley- Hamilton theorem. **Applications:** Structural Analysis, Balancing equations. **(RBT Levels: L1, L2 and L3).**	

Module-2 Calculus	**8 hours**
Polar coordinates, Polar curves, angle between the radius vector and tangent, angle between two curves. Pedal equation. Curvature and Radius of curvature – Cartesian and Polar forms (with proof). Problems. **Self-study:** Radius of curvature-Parametric form, Center and circle of curvature, evolutes and involutes. **Applications:** Structural design and paths, Strength of materials, Elasticity. **(RBT Levels: L1, L2 and L3)**	

Module-3 Series Expansion and Multivariable Calculus	**8 hours**
Taylor's series, Maclaurin's series expansion for one variable (Statement only) – problems. Partial differentiation, total derivative - differentiation of composite functions. Jacobian and problems. Maxima and minima for a function of two variables. Problems. **Self-study:** Euler's theorem and problems. Method of Lagrange's undetermined multipliers with single constraint. **Applications:** Computation of stress and strain, Errors and approximations, Estimating the critical points and extreme values. **(RBT Levels: L1, L2 and L3)**	

Module-4 Ordinary Differential Equations (ODEs) of first order	**8 hours**
Bernoulli's differential equations. Exact and reducible to exact differential equations - Integrating factors on $\frac{1}{\;}(- \square -)$ and $\frac{1}{\;}(- \square -)$. Applications of ODE's - Orthogonal Trajectories and L-R circuits. Problems. **Non-linear differential equations:** Introduction to general and singular solutions, Solvable for p only, Clairaut's equations. Problems. **Self-Study:** Applications of ODE's, Solvable for x and y. **Applications:** Rate of Growth or Decay, Conduction of heat. (RBT Levels: L1, L2 and L3)	

Module-5 Integral Calculus	**8 hours**
Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by changing the order of integration. Applications to find Area and Volume by double and triple integral. Problems.	

Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions (with proof). **Problems.**

Self-Study: Evaluation of double integrals by changing into Polar co-ordinates, Center of gravity, Duplication formula. Reduction formulae
Applications: Applications to mathematical quantities (Area, Surface area, Volume).
(RBT Levels: L1, L2 and L3)

List of Laboratory experiments (2 hours/week per batch/ batch strength 15)
10 lab sessions + 1 repetition class + 1 Lab Assessment

1	2D plots for Cartesian and polar curves
2	Finding angle between polar curves, curvature and radius of curvature of a given curve
3	Finding partial derivatives, Jacobian and plotting the graph
4	Applications to Maxima and Minima of two variables
5	Solution of first order differential equation and plotting the graphs
6	Evaluation of Double & Triple Integrals (With and Without Limits)
7	Rank of a Matrix
8	Numerical solution of system of linear equations, test for consistency and graphical representation
9	Solution of system of linear equations using Gauss-Seidel iteration
10	Compute eigen values and eigen vectors and find the largest eigen value by Rayleigh power method.

Suggested software's: Mathematica / MatLab / Python / Scilab

COURSE OUTCOMES:

CO1	Apply matrix theory for solving for system of linear equations and compute Eigen values and Eigen vectors
CO2	Apply the knowledge of calculus to solve problems related to polar curves
CO3	Compute rate of change multi variate functions by using the notion of partial differentiation.
CO4	Solve the first order linear/non-linear differential equations analytically using standard methods
CO5	Apply the concept of change the order of the Integration and variables to evaluate multiple integrals and their usage in computing the area and the volumes.

Assessment Details

CIE for the Theory component: 30 Marks

	Components	Number	Weightage	Max. Marks
1	Tests (A)	3	60%	18
2	Alternate Assessment Tools(AAT) (B)	3	40%	12
	Total Marks for theory component A+B			30

CIE for the LAB component: 20 Marks

On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.

The laboratory test (duration 02/03 hours) at the end of the 14th /15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for20 marks.

Final CIE Marks (Maximum) for IC Courses = 30 + 20 = 50
SEE for IC Theory for 3 hours duration

The question paper will have ten questions. Each question is set for 20 marks.

There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)

The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IC, the total marks of all questions should not be more than the 30 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources: -

Books (Title of the Book / Name of the author / Name of the publisher / Edition and Year)

Text Books:

B.S.Grewal: "Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021

E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.

Reference Books:

V.Ramana: "Higher Engineering Mathematics "McGraw-Hill Education, 11th Ed., 2017

Srimanta Pal & Subodh C. Bhunia: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.

Semester: I/II

Course Title: Physics for Civil Engineering Stream

Course Code:	**22PHYC12/22**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:2:2:0	Exam Hours	03+02
Total Hours of Pedagogy	40 hours Theory + 10-12 Lab Slots	Credits	04

Module-1 **8 Hours**

Oscillations and Shock waves:
Oscillations: Simple Harmonic motion (SHM), Differential equation for SHM (Derivation), Sprigs: Stiffness Factor and its Physical Significance, series and parallel combination of springs (Derivation), Types of spring and their applications. Theory of damped oscillations (Qualitative), Types of damping (Graphical Approach). Engineering applications of damped oscillations, Theory of forced oscillations (Qualitative), resonance and sharpness of resonance.
Shock waves: Mach number and Mach Angle, Mach Regimes, definition and characteristics of Shock waves, Construction and working of Reddy shock tube, Applications of Shock Waves.
Numerical problems: Spring constant, Time period, Mach number.
Pre-requisites: Basics of Oscillations
Self-learning: Definition of waves, types of waves, difference between light and sound waves.

Module-2 **8 Hours**

Elasticity: Stress-Strain Curve, Stress hardening and softening. Elastic Moduli, Poisson's ratio and its limiting values. Relation between Y, n and σ (Derivation), Beams, bending moment (Derivation), Y by Cantilever (Derivation) and I section girder and their Engineering Applications, Elastic materials (Qualitative). Failures of engineering materials: ductile fracture, brittle fracture, stress concentration, fatigue and factors affecting fatigue (only qualitative explanation).
Numerical problems: Elastic Moduli, Y by cantilever
Pre-requisites: Elasticity, Stress & Strain
Self-learning: Hooks law, Plasticity

Module-3 **8 Hours**

Photonics:
LASER: Metastable State, Interaction of Radiation with Matter, Einstein's coefficients (A and B), Requisites of LASER, LASER action (Population Inversion), Semiconductor LASER, Properties of a LASER Beam, Applications: LASER Range Finder, LIDAR, Road Profiling, Bridge Deflection, Speed Checker.
Optical Fiber: Principle and Construction of Optical Fibers, Acceptance angle and acceptance cone, Expression for NA (Derivation), Modes of Propagation, Fiber Losses, Attenuation coefficient (Derivation), Applications: Fiber Optic Displacement Sensor, Fiber Optic Temperature Sensor.
Numerical Problems: Power of LASER, Papulation inversion, Numerical aperture, Attenuation coefficient.
Pre-requisite: Properties of light, Wave guides
Self-learning: Laser cooling application, Propagation Mechanism (Optical Fibers)

Module-4 **8 Hours**

Natural hazards and Safety: Introduction, Earthquake, (general characteristics, Physics of earthquake, Richter scale of measurement and earthquake resistant measures), Tsunami (causes for tsunami, characteristics, adverse effects, risk reduction measures, engineering structures to withstand tsunami), Land slide (causes such as excess rainfall, geological structure, human excavation etc, types of landslide, adverse effects, engineering solution for landslides). Forest Fires and detection using remote sensing. Fire hazards and fire protection, fire-proofing materials, fire safety regulations and firefighting equipment - Prevention and safety measures.
Numerical problems:
Pre-requisite: Knowledge about natural disaster's
Self-learning: Environment and waste management

Module-5 **8 Hours**

Acoustics, Radiometry and Photometry:
Acoustics: Introduction to acoustics, Types of Acoustics, Reverberation and Reverberation time, Absorption power and absorption coefficient, Requisites for acoustics in auditorium, Sabine's formula (derivation), measurement of

absorption coefficient, factors affecting the acoustics and remedial measures, Noise and its Measurements, Sound Insulation and its measurements. Impact of Noise in Multi-storied buildings.
Radiometry and Photometry: Radiation quantities, Spectral Quantities, Relation between luminescence and radiant quantities, Reflectance and Transmittance, Photometry (cosine law and inverse square law).
Numerical problems: Reverberation time, Sabine's formula, Absorption coefficient
Pre-requisites: Waves, Basics of Sound waves.
Self-learning: Introduction to acoustics, sound waves and its properties

Suggested Learning Resources:
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Materials Science and Engineering by R Balasubramaniam, second edition, Wiley India Pvt. Ltd. Ansari Road, Daryaganj, New Delhi-110002.
2. A textbook of Engineering Physics by M .N. Avadhanulu, P G. Kshirsagar and T V S Arun Murthy, Eleventh edition, S Chand and Company Ltd. New Delhi-110055.
3. Engineering Physics by R. K. Gaur and S. L. Gupta, 2010 edition, Dhanpat Rai Publications Ltd., New Delhi-110002,
4. Building Science: Lighting and Acoustics, B. P. Singh and Devaraj Singh, Dhanpat Rai Publications (P) Ltc.,
5. Building Acoustics: Tor Eric Vigran, Taylor and Francis, 2008 Edition.
6. Photometry Radiometry and Measurements of Optical Losses, MichealBukshtab, Springer, 2nd edition.
7. Materials Science for Engineers by James F. Shackelford and Madanapalli K Muralidhara, sixth edition, Pearson Education Asia Pvt. Ltd., New Delhi.
8. Lasers and Non-Linear Optics, B B Loud, New Age Internationals, 2011 edition
9. Shock waves made simple by Chintoo S Kumar, K Takayama and K P J Reddy: Willey India Pvt. Ltd, Delhi 2014.
10. An Introduction to Disaster Management, Natural Disaster & Man-Made Hazards, S. Vaidyanathan, IKON Books P
11. Natural Hazards, Edward Bryant, Cambridge University Press, 2nd Edition
12. Natural hazards, Earthquakes, Volcanoes, and landslides by Ramesh P Singh, and Darius Bartlett, CRC Press, Taylor and Francis group.
13. Principles of Fire Safety Engineering Understanding Fire & Fire Protection, Akhil Kumar Das, PHI Learning, II Edition.
14. Disaster Management, R. Subramanian, S. Chand Publishing,2018.

Laboratory Component:

Any Ten Experiments have to be completed from the list of experiments Note: The experiments have to be classified into

a) Exercise
b) Demonstration
c) Structured Inquiry
d) Open Ended

Based on convenience classify the following experiments into the above categories. Select at least one simulation/spreadsheet activity.

List of Experiments:

1. Uniform Bending
2. n by Torsional Pendulum
3. Forced Mechanical Oscillations and resonance
4. Series & Parallel Resonance
5. Fermi Energy of Conductor
6. Resistivity by Four Probe Method
7. Spring Constant
8. Single Cantilever
9. I by torsional pendulum
10. Wavelength of Hg source by Diffraction grating
11. Optical Fiber
12. Newton's Rings
13. GNU Step Interactive Simulations

14. Study of motion using spread Sheets
15. Application of Statistics using Spread Sheet
    PHET Interactive Simulations:
    (https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype)

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

CO1	Elucidate the concepts in oscillations and shock waves,
CO2	Elucidate the properties of elasticity and material failures
CO3	Describe the principles of LASERS and Optical fibers and their relevant applications.
CO4	Describe the various natural hazards and safety precautions, Summarize concepts of acoustics in buildings and explain the concepts in radiation and photometry
CO5	Practice working in groups to conduct experiments in Physics and perform precise and honest measurements.

Assessment Details

CIE for the Theory component: 30 Marks

	Components	Number	Weightage	Max. Marks
1	Tests (A)	3	60%	18
2	Alternate Assessment Tools(AAT) (B)	3	40%	12
	Total Marks for theory component A+B			30

CIE for the LAB component: 20 Marks

On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.

The laboratory test (duration 02/03 hours) at the end of the 14th /15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for20 marks.

Final CIE Marks (Maximum) for IC Courses = 30 + 20 = 50

SEE for IC Theory for 3 hours duration

The question paper will have ten questions. Each question is set for 20 marks.

There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)

The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IC, the total marks of all questions should not be more than the 30 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Semester: I/II

Course Title: Chemistry for Civil Engineering stream

Course Code:	**22CHEC12/22**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:2:2:0	Exam Hours	03+02
Total Hours of Pedagogy	40 hours Theory + 10 to 12 Lab slots	Credits	04

Module-1: Structural Materials and Energy sources **8 Hours**

Metals and Alloys: Introduction, Properties and application of Iron and its alloys, Aluminum and its alloys
Cement: Introduction, composition, properties, classification, manufacturing process of cement, process of setting and hardening of cement, additives for cement and testing of cement.
Fuels: Introduction, calorific value, determination of calorific value using bomb calorimeter, numerical problems on GCV and NCV.
Green Fuels: Introduction, power alcohol, synthesis and applications of biodiesel.
High Energy Fuels: Production of hydrogen by electrolysis of water and its advantages.
Self-learning: Chemistry of reinforced concrete from various sources of water (seawater, groundwater, treated water).

Module-2: Energy Conversion, Storage and Corrosion **8 Hours**

Energy Conversion: Introduction, construction, working and applications of Photovoltaic cells, methanol-oxygen fuel cell.
Storage Devices: Introduction, construction and working of Li-ion battery.
Corrosion: Introduction, electrochemical corrosion of steel in concrete, types (differential metal and aeration), Stress corrosion in civil structures, corrosion control (design and selection of materials, galvanization, anodization and sacrificial anode method).
Metal Finishing: Introduction, Technological importance. Electroplating: Introduction, Electro less plating: Introduction, Distinction between electroplating and electro less plating process.
Self-learning: Corrosion inhibitors

Module-3: Water Technology and Nanotechnology **8 Hours**

Water Technology: Introduction, water parameters, hardness of water, determination of temporary, permanent and total hardness by EDTA method, numerical problems, softening of water by ion exchange method, desalination of water by electro-dialysis, determination of COD, numerical problems.
Reverse osmosis: Introduction, Process and applications.
Nanotechnology: Introduction, size dependent properties of nanomaterial (surface area and catalytic), Synthesis of nanomaterial by sol-gel method and co-precipitation method.
Nano Materials: Introduction, properties and engineering applications of carbon nanotubes, graphene and nanomaterials for water treatment (Metal oxide).
Self-learning: Sewage treatment (Primary, secondary and tertiary)

Module-4:Macromolecule Polymer and Composites for Engineering Applications **8 Hours**

Polymers: Introduction, methods of polymerization (Condensation and Addition), molecular weight; number average and weight average, numerical problems. Synthesis, properties and industrial applications of polyvinylchloride (PVC) and polystyrene.
Fibers: Introduction, synthesis, properties and industrial applications of Kevlar and Polyester.
Geopolymer Concretes: Introduction, synthesis, constituents, properties and applications.
Plastics: Introduction, synthesis, properties and industrial applications of poly (methyl methacrylate) (PMMA) and Teflon.
Adhesives: Introduction, properties and applications of epoxy resin.
Biodegradable Polymers: Synthesis of polylactic acid (PLA) and their applications
Lubricants: Introduction, classification, properties and applications of lubricants

Self-learning: Biopolymer: Introduction, structural properties, and applications of cellulose and lignin.

Module-5:Phase Rule and Analytical Techniques **8 Hours**

Phase Rule: Introduction, Definition of terms: phase, components, degree of freedom, phase rule equation. Phase diagram: Two component-lead-silver system.
Analytical Techniques: Introduction, principle, instrumentation of potentiometric sensors and its application in the estimation of iron, conductometric sensors and its application in the estimation of acid mixture, Optical sensors and its application in the estimation of the beverages,

Self-learning: Chromatographic technique, application of chromatography (column and thin-layered chromatography) in the separation of components.

PRACTICAL MODULE

A – Demonstration (any two) offline/virtual:
A1. Synthesis of polyurethane
A2. Quantitative estimation of Aluminium by precipitation method
A3. Synthesis of iron oxide nanoparticles
A4. Determination of chloride content in the given water sample by Argentometric method

B – Exercise (compulsorily any 4 to be conducted):
B1.Conductometric estimation of acid mixture
B2. Potentiometric estimation of FAS using K2Cr2O7
B3. Determination of pKa of vinegar using pH sensor (Glass electrode)
B4. Determination of rate of corrosion of mild steel by weight loss method
B5.Estimation of total hardness of water by EDTA method

C – Structured Enquiry (compulsorily any 4 to be conducted):
C1. Estimation of Copper present in electroplating effluent by optical sensor (colorimetry)
C2. Determination of Viscosity coefficient of lubricant (Ostwald's viscometer)
C3. Estimation of iron in TMT bar by diphenyl amine/external indicator method
C4. Estimation of Sodium present in soil/effluent sample using flame photometry
C5. Determination of Chemical Oxygen Demand(COD) of industrial waste water sample

D – Open Ended Experiments (any two):
D1. Gravimetric estimation of gypsum in Portland cement
D2. Electroplating of desired metal on substrate
D3. Estimation of manganese dioxide in pyrolusite
D4. Analysis of cement for its components

Course outcomes:
At the end of the course the student will be able to:

1.	Apply structural materials for engineering applications and synthesis of alternative energy sources
2.	Demonstrate energy conversion and storage in batteries, fuel cells and solar cells and corrosion control methods.
3.	Apply basic concepts of chemistry in nanomaterials and water technology to solve engineering problems.
4.	Analyze the properties and applications of macromolecular polymers for engineering applications
5.	Solve for the problems in chemistry pertinent in engineering applications using phase rule and analytical techniques

Assessment Details

CIE for the Theory component: 30 Marks

	Components	Number	Weightage	Max. Marks
1	Tests (A)	3	60%	18
2	Alternate Assessment Tools(AAT) (B)	3	40%	12
	Total Marks for theory component A+B			**30**

CIE for the LAB component: 20 Marks

On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.
The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.

The laboratory test (duration 02/03 hours) at the end of the 14th /15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.
Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for20 marks.

Final CIE Marks (Maximum) for IC Courses = 30 + 20 = 50
SEE for IC Theory for 3 hours duration

The question paper will have ten questions. Each question is set for 20 marks.

There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)

The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IC, the total marks of all questions should not be more than the 30 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Wiley Engineering Chemistry, Wiley India Pvt. Ltd. New Delhi, 2013- 2nd Edition.
2. Engineering Chemistry, Satyaprakash & Manisha Agrawal, Khanna Book Publishing, Delhi
3. A Text Book of Engg. Chemistry, Shashi Chawla, Dhanpat Rai & Co. (P) Ltd.
4. Essentials of Physical Chemistry, Bahl & Tuli, S. Chand Publishing
5. Applied Chemistry, Sunita Rattan, Kataria 5. Engineering Chemistry, Baskar, Wiley
6. Engineering Chemistry – I, D. Grour Krishana, Vikas Publishing
7. A Text book of Engineering Chemistry, SS Dara & Dr. SS Umare, S Chand & Company Ltd., 12th Edition, 2011.
8. A Text Book of Engineering Chemistry, R.V. Gadag and Nityananda Shetty, I. K. International Publishing house. 2nd Edition, 2016.
9. Text Book of Polymer Science, F.W. Billmeyer, John Wiley & Sons, 4th Edition, 1999.
10. Nanotechnology A Chemical Approach to Nanomaterials, G.A. Ozin & A.C. Arsenault, RSC Publishing, 2005.
11. Corrosion Engineering, M. G. Fontana, N. D. Greene, McGraw Hill Publications, New York, 3rd Edition, 1996.
12. Linden's Handbook of Batteries, Kirby W. Beard, Fifth Edition, McGraw Hill, 2019.
13. OLED Display Fundamentals and Applications, TakatoshiTsujimura, Wiley–Blackwell , 2012
14. Supercapacitors: Materials, Systems and Applications, Max Lu, Francois Beguin, Elzbieta Frackowiak, Wiley-VCH; 1st edition, 2013.
15. “Handbook on Electroplating with Manufacture of Electrochemicals”, ASIA PACIFIC BUSINESS PRESS Inc., 2017. Dr. H. Panda,
16. Expanding the Vision of Sensor Materials. National Research Council 1995, Washington, DC: The National Academies Press. doi: 10.17226/4782.
17. Engineering Chemistry, Edited by Dr. Mahesh B and Dr. Roopashree B, Sunstar Publisher, Bengaluru, ISBN 978-93-85155-70-3, 2022
18. High Performance Metallic Materials for Cost Sensitive Applications, F. H. Froes, et al. John Wiley & Sons, 2010
19. Instrumental Methods of Analysis, **Dr.K. R.Mahadik** and **Dr.L.Sathiyanarayanan,** NiraliPrakashan, 2020
20. Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, Stanley R. Crouch Seventh Edition, Cengage Learning, 2020
21. Polymer Science, **V R Gowariker,** N V Viswanathan, Jayadev, Sreedhar, Newage Int. Publishers, 4th Edition, 2021
22. Engineering Chemistry, P C Jain & Monica Jain, Dhanpat Rai Publication, 2015-16th Edition.
23. Nanostructured materials and nanotechnology, Hari Singh, Nalwa, academic press, 1st Edition, 2002.
24. Nanotechnology Principles and Practices, Sulabha K Kulkarni, Capital Publishing Company, 3rd Edition 2014
25. Principles of nanotechnology, Phanikumar, Scitech publications, 2nd Edition, 2010.
26. Chemistry for Engineering Students, B. S. Jai Prakash, R. Venugopal, Sivakumaraiah& Pushpa Iyengar., Subash Publications, 5th Edition, 2014
27. “Engineering Chemistry”, O. G. Palanna, Tata McGraw Hill Education Pvt. Ltd. New Delhi, Fourth Reprint, 2015.
28. Chemistry of Engineering materials, Malini S, K S Anantha Raju, CBS publishers Pvt. Ltd.,
29. Laboratory Manual Engg. Chemistry, Anupma Rajput, Dhanpat Rai & Co.

Semester: I/II

Course Title: Engineering Mechanics

Course Code:	**22CIV13/23**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	(3:0:0)	Exam Hours	03
Total Hours of Pedagogy	40 hours Theory	Credits	03

Pre-requisites:

Applied mathematics (limits, differential, integral calculus).

Applied physics and general pictorial view of the construction activities been carried out in the vicinity like roads, bridges, buildings etc.

Module – 1: Introduction to Engineering Mechanics **8 Hours**

Introduction to Engineering Mechanics: Basic idealizations - Particle, Continuum and Rigid body; Force and its characteristics, types of forces, Classification of force systems; Principle of physical independence of forces, Principle of superposition of forces, Principle of transmissibility of forces; Newton's laws of motion, Introduction to SI units. Couple, Moment of a couple, Characteristics of couple, Moment of a force, Equivalent force - Couple system; Numerical problems on moment of forces and couples, on equivalent force - couple system.

(RBT Levels:L1,L2,L3)

Teaching-Learning Process: PowerPoint presentation and videos

Module – 2: Analysis of Force Systems- Concurrent & Non Concurrent System **8 Hours**

Concurrent Force System : Composition of forces - Definition of Resultant; Composition of coplanar - concurrent force system, Parallelogram Law of forces, Principle of resolved parts; Numerical problems on composition of coplanar concurrent force systems.

Non Concurrent Force System: Composition of coplanar - non-concurrent force system, Varignon's principle of moments; Numerical problems on composition of coplanar non-concurrent Force system.

(RBT Levels:L1,L2,L3)

Teaching-Learning Process: Activity-based learning, PowerPoint presentation and videos.

Module – 3: Equilibrium of Forces & Support Reactions **8 Hours**

Equilibrium of Forces: Equilibrium of Concurrent and Non-concurrent Forces: Equilibrium of forces - Definition of Equilibrant; Conditions of static equilibrium for different force systems, Lami's theorem; Numerical problems on equilibrium of coplanar – concurrent and non-concurrent force systems.

Support Reactions: Types of Loads and Supports, statically determinate beams, Numerical problems on support reactions for statically determinate beams with Point load (Normal and inclined), uniformly distributed loads and uniformly varying loads.

(RBT Levels:L1,L2,L3)

Teaching-Learning Process: Chalk and talk, videos, PowerPoint Presentation, animations.

Module – 4: Centroid and Moment of Inertia **8 Hours**

Centroids: Introduction to the concept, Centroid of line and area, centroid of basic geometrical figures, computing centroid for composite lines and Engineering composite sections – T, L, I and Z & full quadrant Circular sections and their built up sections, Numerical problems

Moment of Inertia: Introduction to the concept, Radius of gyration, Parallel axis theorem, Perpendicular axis theorem, Moment of Inertia of basic planar figures, computing moment of Inertia for Engineering composite sections – T, L, I and Z & full quadrant Circular sections and their built up sections, Numerical problems.

(RBT Levels:L1,L2,L3)

Teac□in□Learnin□ Process: Chalk and talk, videos, PowerPoint Presentation, animations.

Module – 5: Analysis of Trusses & Friction **8 Hours**

Introduction, Classification of trusses, analysis of plane perfect trusses by the method of joints and method of sections, Numerical examples.

Friction: Introduction, laws of Coulomb friction, equilibrium of blocks on horizontal plane,
Equilibrium of blocks on inclined plane Numerical examples.

(RBT Levels:L1,L2,L3)

Teaching-Learning Process: Chalk and talk, videos, PowerPoint Presentation, animations.

COURSE OUTCOMES:
Upon completion of this course, students will be able to.
1. Compute the resultant of a force system and resolution of a force
2. Comprehend the action for forces, moments, and other types of loads on rigid bodies.
3. Analyze the action of Forces, Moments and other loads on systems of rigid bodies and compute the reactive forces
4. Compute the Centroid and Moment of Inertia of regular sections.
5. Analyse the forces in trusses & frictional resistance offered by different planes.

Assessment Details

CIE:

	Components	Number	Weight age	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks will be proportionally reduced to 50.
The question paper will have 10 full questions carrying 20 marks each.
There will be 2 full questions (with maximum of four sub questions) from each module.
The students will have to answer 5 full questions, selecting one full question from each module.

SUGGESTED LEARNING RESOURCES:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Elements of Civil Engineering and Engineering Mechanics	M.N.Shesha Prakash and Ganesh B Mogaveer,	PHI Learning	3rd Revised Edition (2014) 2.
2	Engineering Mechanics.	Reddy Vijaykumar K and K Suresh Kumar,	Singer's	3rd edition
3	Engineering Materials	Rangawala P.C.	Charter Publishing House, Anand, India	43rd Edition
Reference Books				
1	Engineering Mechanics: Principles of Statics and Dynamics	R. C. Hibbbler	Pearson Press	4th Edition
2	Mechanics for Engineers, Statics and Dynamics.	F.P. Beer and E. R. Johnston	McGraw Hill	Volume 1
3	A Text Book of Engineering Mechanics	Bansal R. K	Laxmi Publications.	Revised 6th Edition
4	Elements of Civil engineering and Engineering Mechanics	B.K. Kholapure	Eastern Book Promoters Belgaum	Revised 12th edition (2020)

Semester: II

Course Title: Mathematics for CIVIL Stream-II

Course Code:	**22MATC21**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:2:2:0	Exam Hours	03+02
Total Hours of Pedagogy	40 hours Theory + 10-12 Lab Slots	Credits	04

PRE REQUISITES:

Dot and Cross product of vectors, differentiation and Integration.
Definition of Differential Equations, method of solving first order differential equations.
Concept of partial differentiation. Formation of differential equation.
Solving quadratic and cubic equations.
Solving first order and first degree differential equation analytically.

Module-1 Vector Calculus **8 hours**

Vector Differentiation: Scalar and vector fields. Gradient, directional derivative, curl and divergence – physical interpretation, solenoidal and irrotational vector fields. Problems.
Vector Integration: Line integrals, Surface integrals. Applications to work done by a force and flux. Statement of Green's theorem and Stoke's theorem. Problems.

Self-Study: Volume integral and Gauss divergence theorem.
Applications: Heat and mass transfer, oil refinery problems, environmental engineering. Analysis of stream lines, velocity and acceleration of a moving particle.
(RBT Levels: L1, L2 and L3)

Module-2 Ordinary Differential Equations of higher order **8 hours**

Higher-order linear ODE's with constant coefficients - Inverse differential operator, method of variation of parameters, Cauchy's and Legendre homogeneous differential equations. Problems.

Self-Study: Formulation and solution of oscillations of a spring. Finding the solution by the method of undetermined coefficients.
Applications: Oscillations of a spring, Transmission lines, highway engineering.

Module-3 Partial Differential Equations (PDE's) **8 hours**

Formation of PDE's by elimination of arbitrary constants and functions. Solution of non- homogeneous PDE by direct integration. Homogeneous PDEs involving derivative with respect to one independent variable only. Solution of Lagrange's linear PDE. **Derivation of one-dimensional heat equation and wave equation.**
Self-Study: Solution of one-dimensional heat equation and wave equation by the method of separation of variables.
Applications: Design of structures (vibration of rod/membrane).
(RBT Levels: L1, L2 and L3)

Module-4 Numerical methods -1 **8 hours**

Solution of algebraic and transcendental equations - Regula-Falsi and Newton-Raphson methods (only formulae). Problems.
Finite differences, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference formula and Lagrange's interpolation formula (All formulae without proof). Problems.
Numerical integration: Trapezoidal, Simpson's $(1/3)^{rd}$ and $(3/8)^{th}$ rules (without proof). Problems.

Self-Study: Ramanujan's method, Bisection method, Lagrange's inverse Interpolation, Weddle's rule. **Applications:** Estimating the approximate roots, extremum values, Area, volume, surface area. Finding approximate solutions to civil engineering problems.
(RBT Levels: L1, L2 and L3)

Module-5 Numerical methods -2	**8 hours**
Numerical Solution of Ordinary Differential Equations (ODE's): Numerical solution of ordinary differential equations of first order and first degree - Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor-corrector formula (No derivations of formulae). Problems. **Self-Study:** Adam-Bashforth method. **Applications:** Finding approximate solutions to ODE related to civil engineering fields. **(RBT Levels: L1, L2 and L3).**	

List of Laboratory experiments (2 hours/week per batch/ batch strength 15)
10 lab sessions + 1 repetition class + 1 Lab Assessment

1	Finding gradient, divergent, curl and their geometrical interpretation
2	Solution of second order differential equations
3	Verification of Green's theorem
4	Solution of one-dimensional heat equation and wave equation
5	Solution of algebraic and transcendental equation by Ramanujan's, Regula-Falsi and Newton-Raphson method
6	Interpolation/Extrapolation using Newton's forward and backward difference formula
7	Computation of area under the curve using Trapezoidal, Simpson's $(1/3)^{rd}$ and $(3/8)^{th}$ rule
8	Develop a program to solve ODE of first order and first degree by Taylor's series and Modified Euler's method
9	Develop a program to solve ODE of first order and first degree by R-K 4th order method
10	Develop a program to solve ODE of first order and first degree by Milne's predictor-corrector method

Suggested software's : Mathematica/MatLab/Python/Scilab

COURSE OUTCOMES:

CO1	Apply concept of vector calculus to solenoidal, irrotational vectors, Orthogonal curvilinear coordinates.
CO2	Demonstrate various physical models through higher order differential equations and solve such linear ordinary differential equations.
CO3	Demonstrate partial differential equations and their solutions for physical interpretations.
CO4	Apply the knowledge numerical methods in solving physical and engineering phenomena.
CO5	Solve first order ODE arising in flow data design problems using appropriate single and multi-step numerical methods.

Assessment Details

CIE for the Theory component: 30 Marks

	Components	Number	Weightage	Max. Marks
1	Tests (A)	3	60%	18
2	Alternate Assessment Tools(AAT) (B)	3	40%	12
	Total Marks for theory component A+B			30

CIE for the LAB component: 20 Marks

On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.

The laboratory test (duration 02/03 hours) at the end of the 14th /15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for20 marks.

Final CIE Marks (Maximum) for IC Courses = 30 + 20 = 50
SEE for IC Theory for 3 hours duration

The question paper will have ten questions. Each question is set for 20 marks.

There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)

The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IC, the total marks of all questions should not be more than the 30 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year) Text Books

1. B. S. Grewal: "Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021.
2. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.

Reference Books

1. V. Ramana: "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed., 2017
2. Srimanta Pal & Subodh C. Bhunia: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
3. N.P Bali and Manish Goyal: "A textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
4. C. Ray Wylie, Louis C. Barrett: "Advanced Engineering Mathematics" McGraw – Hill Book Co., Newyork, 6th Ed., 2017.
5. Gupta C.B, Sing S.R and Mukesh Kumar: "Engineering Mathematic for Semester I and II", Mc-Graw Hill Education (India) Pvt. Ltd 2015.
6. H. K. Dass and Er. Rajnish Verma: "Higher Engineering Mathematics" S. Chand Publication, 3rd Ed., 2014.
7. James Stewart: "Calculus" Cengage Publications, 7th Ed., 2019.
8. David C Lay: "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018.
9. Gareth Williams: "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6th Ed., 2017.

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COMPUTER SCIENCE & ENGINEERING STREAM

1st / 2nd Semester Scheme and Syllabus
(Effective from the academic year 2022-23)

Scheme of Teaching and Examinations-2022
Outcome-Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2022-23)

I Semester (CSE Stream) (Physic Group)													
SN	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	*ASC(IC)	**22MATS11	Mathematics for CSE Stream-I	Maths	2	2	2	0	03	50	50	100	04
2	#ASC(IC)	22PHYS12	Physics for CSE stream	Physics	2	2	2	0	03	50	50	100	04
3	ESC	22POP13	Principles of Programming Using C	CSE	2	2	0	0	03	50	50	100	03
4	ESC-I	22ESC14x	Engineering Science Course-I	Respective Engg Dept.	3	0	0	0	03	50	50	100	03
5	ETC-I	22ETC15x	Emerging Technology Course-I	Any Dept.	3	0	0	0	03	50	50	100	03
	OR												
	PLC-I	22PLC15x	Programming Language Course-I		2	0	2	0	03				
6	AEC	22ENG16	Communicative English	Humanities	1	0	0	0	01	50	50	100	01
7	HSMC	22KSK17/ 22KBK17	Samskrutika Kannada/ Balake Kannada	Humanities	1	0	0	0	01	50	50	100	01
		OR											
		22ICO17	Indian Constitution										
8	AEC/SDC	22IDT18	Innovation and Design Thinking	Any Dept.	1	0	0	0	01	50	50	100	01
		OR			OR								
		22SFH18	Scientific Foundations of Health		1	0	0	0	01				
				TOTAL						400	400	800	20

SDA-Skill Development Activities, **TD/PSB**- Teaching Department / Paper Setting Board, **ASC**-Applied Science Course, **ESC**- Engineering Science Courses, **ETC**- Emerging Technology Course, **AEC**- Ability Enhancement Course, HSMS-Humanity and Social Science and management Course, SDC- Skill Development Course, **CIE** –Continuous Internal Evaluation, **SEE**- Semester End Examination, **IC** – Integrated Course (Theory Course Integrated with Practical Course)

Credit Definition:
1-hour Lecture (L) per week=**1Credit**
2-hoursTutorial(T) per week=**1Credit**
2-hours Practical / Drawing (P) per week=**1Credit**
2-hous Skill Development Actives (SDA) per week = **1 Credit**

04-Credits courses are to be designed for 50 hours of Teaching-Learning Session 04-Credits (IC) are to be designed for 40 hours' theory and 12-14 hours of practical sessions
03-Credits courses are to be designed for 40 hours of Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 12-15 hours of Teaching-Learning sessions

Student's Induction Program: Motivating (Inspiring) Activities under the Induction program – The main aim of the induction program is to provide newly admitted students a broad understanding of society, relationships, and values. Along with the knowledge and skill of his/her study, students' character needs to be nurtured as an essential quality by which he/she would understand and fulfill the responsibility as an engineer. The following activities are to be covered in 21 days. Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to Local areas, Familiarization with Department/Branch and Innovation, etc. For details, refer the ANNEXUREI of Induction Programs notification of the University published at the beginning of the 1st semester.

AICTE Activity Points to be earned by students admitted to BE/ B.Tech., / B. Plan day college program (For more details refer to Chapter 6, AICTE Activity Point Program, Model Internship Guidelines): Over and above the academic grades, every regular student admitted to the 4 years Degree program and every student entering 4 years Degree programs through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Program. Students transferred from other Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, any time during the semester weekends, and holidays, as per the liking and convenience of the student from the year of entry to the program. However, the minimum hour's requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, an Eighth Semester Grade Card shall be issued only after earning the required activity points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

***-22MATC11** Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory question papers ** **The mathematics subject should be taught by a single faculty member per division, with no sharing of the course(subject)module-wise by different faculty members.**
#-22PHYC12 SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination
ESC or ETC of 03 Credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature of the course required practical learning then the syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0).
All 01 Credit- courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

(ESC-I) Engineering Science Courses-I					(ETC-I) Emerging Technology Courses-I				
Code	**Title**	**L**	**T**	**P**	**Code**	**Title**	**L**	**T**	**P**
22ESC141	Introduction to Civil Engineering	3	0	0	22ETC15A	Smart materials and Systems	3	0	0
22ESC142	Introduction to Electrical Engineering	3	0	0	22ETC15B	Green Buildings	3	0	0
22ESC143	Introduction to Electronics Engineering	3	0	0	22ETC15E	Renewable Energy Sources	3	0	0
22ESC144	Introduction to Mechanical Engineering	3	0	0	22ETC15F	Drone technology	3	0	0
22ESC145	Introduction to C Programming	2	0	2	22ETC15G	Introduction to Sustainable Engineering	3	0	0
					22ETC15H	Introduction to Internet of Things(IoT)	3	0	0
					22ETC15I	Waste Management	3	0	0
					22ETC15J	Introduction to Cyber Security	3	0	0
(PLC-I) Programming Language Courses-I									
Code	**Title**	**L**	**T**	**P**					
22PLC15A	Introduction to Web Programming	2	0	2					
22PLC15B	Introduction to Python Programming	2	0	2					
22PLC15C	Basics of JAVA programming	2	0	2					
22PLC15D	Introduction to C++ Programming	2	0	2					
The course 22ESC145/245, Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT									

- The student has to select one course from the ESC-I group.
- CSE/ISE and allied branches Students shall opt for any one of the courses from the ESC-I group except, 22ESC145-Introduction to C Programming
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-I or PLC-I group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

Scheme of Teaching and Examinations-2022
Outcome-Based Education (OBE) and Choice Based Credit System (CBCS) (Effective from the academic year 2022-23)
II Semester (CSE Stream) (for students who attended I semester under Physics Group)

SN	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	*ASC(IC)	**22MATS21	Mathematics for CSE Stream-II	Maths	2	2	2	0	03	50	50	100	04
2	#ASC(IC)	22CHES22	Chemistry for CSE Stream	Chemistry	2	2	2	0	03	50	50	100	04
3	ESC	22CED23	Computer-Aided Engineering Drawing	Civil/Mech. Engg Dept.	2	0	2	0	03	50	50	100	03
4	ESC-II	22ESC24x	Engineering Science Course-II	Respective Engg Dept.	3	0	0	0	03	50	50	100	03
5	PLC-II	22PLC25x	Programming Language Course-II	Any. Dept.	2	0	2	0	03	50	50	100	03
	OR												
	ETC-II	22ETC25x	Emerging Technology Course-II		3	0	0	0	03				
6	AEC	22PWS26	Professional Writing Skills in English	Humanities	1	0	0	0	01	50	50	100	01
7	HSMS	22ICO27	Indian Constitution	Humanities	1	0	0	0	01	50	50	100	01
		OR											
		22KSK27 22KBK27	Samskrutika Kannada/ Balake Kannada										
8	HSMS	22SFH28	Scientific Foundations of Health	Any Dept.	1	0	0	0	01	50	50	100	01
	OR				OR								
	HSMS	22ITD29	Innovation and Design Thinking	Any	1	0	0	0	01	50	50	100	
TOTAL										400	400	800	20

SDA-Skill Development Activities, TD/PSB- Teaching Department / Paper Setting Board, ASC-Applied Science Course, ESC- Engineering Science Courses, ETC- Emerging Technology Course, AEC- Ability Enhancement Course, HSMS-Humanity and Social Science and management Course, SDC- Skill Development Course,
CIE -Continuous Internal Evaluation, SEE- Semester End Examination, IC – Integrated Course (Theory Course Integrated with Practical Course)

Credit Definition: 1-hour Lecture (L) per week=1Credit 2-hoursTutorial(T) per week=1Credit 2-hours Practical / Drawing (P) per week=1Credit 2-hous Skill Development Actives (SDA) per week = 1 Credit	04-Credits courses are to be designed for 50 hours of Teaching-Learning Session 04-Credits (IC) are to be designed for 40 hours' theory and 12-14 hours of practical sessions 03-Credits courses are to be designed for 40 hours of Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 12-15 hours of Teaching-Learning sessions

***-22MAT21** Shall have the 03 hours of theory examination (SEE), however, practical sessions question shall be included in the theory question papers. ** The mathematics subject should be taught by single faculty member per division, with no sharing of the course (subject) module-wise by different faculty members.
#-22CHE22- SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination
ESC or ETC of 03 credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required practical learning syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0).
All 01 Credit- courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

(ESC-II) Engineering Science Courses-II					(ETC-II) Emerging Technology Courses-II				
Code	Title	L	T	P	Code	Title	L	T	P
22ESC241	Introduction to Civil Engineering	3	0	0	22ETC25A	Smart materials and Systems	3	0	0
22ESC242	Introduction to Electrical Engineering	3	0	0	22ETC25B	Green Buildings	3	0	0
22ESC243	Introduction to Electronics Engineering	3	0	0	22ETC25E	Renewable Energy Sources	3	0	0
22ESC244	Introduction to Mechanical Engineering	3	0	0	22ETC25F	Drone technology	3	0	0
22ESC245	Introduction to C Programming	2	0	2	22ETC25G	Introduction to Sustainable Engineering	3	0	0
					22ETC25H	Introduction to Internet of Things(IoT)	3	0	0
					22ETC25I	Waste Management	3	0	0

					22ETC25J	Introduction to Cyber Security	3	0	0
(PLC-II) Programming Language Courses-II									
Code	**Title**	**L**	**T**	**P**					
22PLC25A	Introduction to Web Programming	2	0	2					
22PLC25B	Introduction to Python Programming	2	0	2					
22PLC25C	Basics of JAVA programming	2	0	2					
22PLC25D	Introduction to C++ Programming	2	0	2					
The course 22ESC145/245, Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT									

- The student has to select one course from the ESC-II group.
- CSE/ISE and allied branches Students shall opt for any one of the courses from the ESC-II group except, 22ESC245-Introduction to C Programming
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-II or PLC-II group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

Scheme of Teaching and Examinations-2022

Outcome-Based Education (OBE) and Choice Based Credit System (CBCS) (Effective from the academic year 2022-23)
I Semester (CSE Stream) (Chemistry Group)

SN	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	*ASC(IC)	**22MATS 11	Mathematics for CSE Stream-I	Maths	2	2	2	0	03	50	50	100	04
2	#ASC(IC)	22CHES12	Chemistry for CSE Stream	Chemistry	2	2	2	0	03	50	50	100	04
3	ESC	22CED13	Computer-Aided Engineering Drawing	Civil/Mech Engg dept	2	0	2	0	03	50	50	100	03
4	ESC-I	22ESC14x	Engineering Science Course-I	Respective Dept.	3	0	0	0	03	50	50	100	03
5	ETC-I	22ETC15x	Emerging Technology Course-I	Any Dept.	3	0	0	0	03	50	50	100	03
	OR												
	PLC-I	22PLC15x	Programming Language Course-I		2	0	2	0	03				
6	AEC	22ENG16	Communicative English	Humanities	1	0	0	0	01	50	50	100	01
7	HSMS	22ICO17	Indian Constitution	Humanities	1	0	0	0	01	50	50	100	01
		OR											
		22KSK17/ 22KBK17	Samskrutika Kannada/ Balake Kannada										
8	HSMS	22SFH18	Scientific Foundations of Health	Any Dept.	1	0	0	0	01	50	50	100	01
	OR												
	HSMS	22ITD18	Innovation and Design Thinking	Any Dept.	1	0	0	0	01				
	TOTAL				**15**	**06**	**10**	**00**	**27**	**400**	**400**	**800**	**20**

SDA-Skill Development Activities, TD/PSB- Teaching Department / Paper Setting Board, ASC-Applied Science Course, ESC- Engineering Science Courses, **ETC-** Emerging Technology Course, AEC- Ability Enhancement Course, HSMS-Humanity and Social Science and management Course, **SDC-** Skill Development Course,

CIE -Continuous Internal Evaluation, SEE- Semester End Examination, IC – Integrated Course (Theory Course Integrated with Practical Course)

***22MAT11** Shall have the 03 hours of theory examination (SEE), however, practical sessions question shall be included in the theory question papers. ** The mathematics subject should be taught by single faculty member per division, with no sharing of the course (subject) module-wise by different faculty members.
#-22CHEC12- SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination
ESC or ETC of 03 credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required practical learning syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0).
All 01 Credit- courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

Credit Definition	
Credit Definition: 1-hour Lecture (L) per week=1Credit 2-hoursTutorial(T) per week=1Credit 2-hours Practical / Drawing (P) per week=1Credit 2-hous Skill Development Actives (SDA) per week = 1 Credit	04-Credits courses are to be designed for 50 hours of Teaching-Learning Session 04-Credits (IC) are to be designed for 40 hours' theory and 12-14 hours of practical sessions 03-Credits courses are to be designed for 40 hours of Teaching-Learning Session 02-Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 12-15 hours of Teaching-Learning sessions

Student's Induction Program: Motivating (Inspiring) Activities under the Induction program – The main aim of the induction program is to provide newly admitted students a broad understanding of society, relationships, and values. Along with the knowledge and skill of his/her study, students' character needs to be nurtured as an essential quality by which he/she would understand and fulfil the responsibility as an engineer. The following activities are to be covered in 21 days. Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to Local areas, Familiarization with Department/Branch and Innovation, etc. For details, refer the ANNEXUREI of Induction Programs notification of the University published at the beginning of the 1st semester.

AICTE Activity Points to be earned by students admitted to BE/ B.Tech., / B. Plan day college program (For more details refer to Chapter 6, AICTE Activity Point Program, Model Internship Guidelines): Over and above the academic grades, every regular student admitted to the 4 years Degree program and every student entering 4 years Degree programs through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Program. Students transferred from other Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, any time during the semester weekends, and holidays, as per the liking and convenience of the student from the year of entry to the program. However, the minimum hour's requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, an Eighth Semester

Grade Card shall be issued only after earning the required activity points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

(ESC-I) Engineering Science Courses-I					(ETC-I) Emerging Technology Courses-I				
Code	**Title**	**L**	**T**	**P**	**Code**	**Title**	**L**	**T**	**P**
22ESC141	Introduction to Civil Engineering	3	0	0	22ETC15A	Smart materials and Systems	3	0	0
22ESC142	Introduction to Electrical Engineering	3	0	0	22ETC15B	Green Buildings	3	0	0
22ESC143	Introduction to Electronics Engineering	3	0	0	22ETC15E	Renewable Energy Sources	3	0	0
22ESC144	Introduction to Mechanical Engineering	3	0	0	22ETC15F	Drone technology	3	0	0
22ESC145	Introduction to C Programming	2	0	2	22ETC15G	Introduction to Sustainable Engineering	3	0	0
					22ETC15H	Introduction to Internet of Things(IoT)	3	0	0
					22ETC15I	Waste Management	3	0	0
					22ETC15J	Introduction to Cyber Security	3	0	0
							3	0	0
(PLC-I) Programming Language Courses-I									
Code	**Title**	**L**	**T**	**P**					
22PLC15A	Introduction to Web Programming	2	0	2					
22PLC15B	Introduction to Python Programming	2	0	2					
22PLC15C	Basics of JAVA programming	2	0	2					
22PLC15D	Introduction to C++ Programming	2	0	2					
The course 22ESC145/245, Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT									

- The student has to select one course from the ESC-I group.
- CSE/ISE & allied branch students shall opt for any one of the courses from the ESC-I group except, 22ESC145-Introduction to C Programming
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-I or PLC-I group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

Scheme of Teaching and Examinations-2022

Outcome-Based Education (OBE) and Choice Based Credit System (CBCS) (Effective from the academic year 2022-23)
II Semester (CSE Stream) (For the students who attended I semester under Chemistry Group)

Sl. No	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week: Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	SDA (S)	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	*ASC(IC)	**22MATS21	Mathematics for CSEStream -II	Maths	2	2	2	0	03	50	50	100	04
2	#ASC(IC)	22PHYS22	Physics for CSE Stream	Physics	2	2	2	0	03	50	50	100	04
3	ESC	22POP23	Principles of Programming Using C	CSE	2	2	0	0	03	50	50	100	03
4	ESC-II	22ESC24x	Engineering Science Course-II	Respective Engg Dept.	3	0	0	0	03	50	50	100	03
5	PLC-II	22PLC25x	Programming Language Course-II	Any Dept.	2	0	2	0	03	50	50	100	03
	OR												
	ETC-II	22ETC25x	Emerging Technology Course-II		3	0	0	0	03				
6	AEC	22PWS26	Professional Writing Skills in English	Humanities	1	0	0	0	01	50	50	100	01
7	HSMC	22KSK27 22KBK27	Samskrutika Kannada/ Balake Kannada	Humanities	1	0	0	0	01	50	50	100	01
		OR											
		22ICO27	Indian Constitution										
8	AEC/SDC	22IDT28	Innovation and Design Thinking	Any Dept.	1	0	0	0	01	50	50	100	01
		OR											
		22SFH28	Scientific Foundations of Health		1	0	0	0					
	TOTAL									**400**	**400**	**800**	**20**

SDA-Skill Development Activities, TD/PSB- Teaching Department / Paper Setting Board, ASC-Applied Science Course, ESC- Engineering Science Courses, ETC- Emerging Technology Course, AEC- Ability Enhancement Course, HSMS-Humanity and Social Science and management Course, SDC- Skill Development Course,
CIE –Continuous Internal Evaluation, SEE- Semester End Examination, IC – Integrated Course (Theory Course Integrated with Practical Course)

-22MATC21** shall have the 03 hours of theory examination (SEE), however, practical sessions question shall be included in the theory question papers. * The mathematics subject should be taught by single faculty member per division, with no sharing of the course (subject) module-wise by different faculty members.**
#-22PHYC22 SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination
ESC or ETC of 03 credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required experimental learning then the syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0). However, there is no SEE for the practical component.
All 01 Credit- courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

(ESC-II) Engineering Science Courses-II

Code	Title	L	T	P
22ESC241	Introduction to Civil Engineering	3	0	0
22ESC242	Introduction to Electrical Engineering	3	0	0
22ESC243	Introduction to Electronics Engineering	3	0	0
22ESC244	Introduction to Mechanical Engineering	3	0	0
22ESC245	Introduction to C Programming	2	0	2

(ETC-II) Emerging Technology Courses-II

Code	Title	L	T	P
22ETC25A	Smart materials and Systems	3	0	0
22ETC25B	Green Buildings	3	0	0
22ETC25E	Renewable Energy Sources	3	0	0
22ETC25F	Drone technology	3	0	0
22ETC25G	Introduction to Sustainable Engineering	3	0	0
22ETC25H	Introduction to Internet of Things(IoT)	3	0	0
22ETC25I	Waste Management	3	0	0
22ETC25J	Introduction to Cyber Security	3	0	0

(PLC-II) Programming Language Courses-II

Code	Title	L	T	P
22PLC25A	Introduction to Web Programming	2	0	2
22PLC25B	Introduction to Python Programming	2	0	2
22PLC25C	Basics of JAVA programming	2	0	2
22PLC25D	Introduction to C++ Programming	2	0	2

The course 22ESC145/245, Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT

- The student has to select one course from the ESC-I group.
- CSE/ISE & allied branch students shall opt for any one of the courses from the ESC-I group except, 22ESC145-Introduction to C Programming
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-I or PLC-I group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

Semester: I

Course Title: Mathematics for CSE Stream-I

Course Code:	**22MATS11**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:2:2:0	Exam Hours	03+02
Total Hours of Pedagogy	40 hours Theory + 10-12 Lab Slots	Credits	04

PRE REQUISITES

- Matrices and Determinants.
- Differentiation basic formulae, differentiation of a function of a function
- Differentiation basic formulae, differentiation of a function of a function
- Definition of Differential Equations, Formation of Differential equations, order and degree of a differential equations. Basic formulae of Integration.
- Basic formulae of Integration and evaluation of Definite Integrals

Module-1 Linear Algebra	**8 hours**
Elementary row transformation of a matrix, Rank of a matrix. Consistency and Solution of system of linear equations - Gauss-Elimination method, Gauss-Jordan method and approximate solution by Gauss-Seidel method. Rayleigh's power method to find the dominant Eigen value and the corresponding Eigenvector. Problems **Self-Study:** Diagonalization of a square matrix of order 2, Solution of system of equations by Gauss-Jacobi iterative method, Inverse of a square matrix by Cayley- Hamilton theorem. **Applications:** Boolean matrix, Network Analysis, Markov Analysis, Critical point of a network system. Optimum solution. **(RBT Levels: L1, L2 and L3)**.	

Module-2 Calculus	**8 hours**
Polar coordinates, Polar curves, angle between the radius vector and tangent, angle between two curves. Pedal equation. Curvature and Radius of curvature – Cartesian and Polar forms (with proof). Problems. **Self-study:** Radius of curvature-Parametric form, Center and circle of curvature, evolutes and involutes. **Applications:** Computer graphics, Image processing. **(RBT Levels: L1, L2 and L3)**	

Module-3 Series Expansion and Multivariable Calculus	**8 hours**
Taylor's series, Maclaurin's series expansion for one variable (Statement only) – problems. Partial differentiation, total derivative - differentiation of composite functions. Jacobian and problems. Maxima and minima for a function of two variables. Problems. **Self-study:** Euler's theorem and problems. Method of Lagrange's undetermined multipliers with single constraint. **Applications:** Series expansion in computer programming, Errors and approximations. **(RBT Levels: L1, L2 and L3)**	

Module-4 Ordinary Differential Equations (ODEs) of first order	**8 hours**
Bernoulli's differential equations. Exact and reducible to exact differential equations - Integrating factors on $\frac{1}{}(— \square —)$ and $\frac{1}{}(— \square —)$. Applications of ODE's - Orthogonal Trajectories and L-R circuits. Problems. **Non-linear differential equations:** Introduction to general and singular solutions, Solvable for p only, Clairaut's equations. Problems. **Self-Study:** Applications of ODE's, Solvable for x and y. **Applications:** L-R & C-R circuits, Rate of Growth or Decay, Conduction of heat. **(RBT Levels: L1, L2 and L3)**	

Module-5 Integral Calculus	**8 hours**
Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by changing the order of integration. Applications to find Area and Volume by double and triple integral. Problem**s.** Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions (with proof). Problems.	

Self-Study: Evaluation of double integrals by changing into Polar co-ordinates, Center of gravity, Duplication formula. Reduction formulae
Applications: Antenna and wave propagation, Calculation of optimum value in various geometries. Analysis of probabilistic models.
(RBT Levels: L1, L2 and L3)

List of Laboratory experiments (2 hours/week per batch/ batch strength 15)
10 lab sessions + 1 repetition class + 1 Lab Assessment

1	2D plots for Cartesian and polar curves
2	Finding angle between polar curves, curvature and radius of curvature of a given curve
3	Finding partial derivatives, Jacobian and plotting the graph
4	Applications to Maxima and Minima of two variables
5	Solution of first order differential equation and plotting the graphs
6	Evaluation of Double & Triple Integrals (With and Without Limits)
7	Rank of a Matrix
8	Numerical solution of system of linear equations, test for consistency and graphical representation
9	Solution of system of linear equations using Gauss-Seidel iteration
10	Compute eigenvalues and eigenvectors and find the largest and smallest eigenvalue by Rayleigh power method.

Suggested software's: Mathematica/MatLab/Python/Scilab

COURSE OUTCOMES:

CO1	Apply matrix theory for solving for system of linear equations and compute Eigen values and Eigen vectors
CO2	Apply the knowledge of calculus to solve problems related to polar curves
CO3	Compute rate of change multi variate functions by using the notion of partial differentiation.
CO4	Solve the first order linear/non-linear differential equations analytically using standard methods
CO5	Apply the concept of change the order of the Integration and variables to evaluate multiple integrals and their usage in computing the area and the volumes.

Assessment Details

CIE for the Theory component: 30 Marks

	Components	Number	Weightage	Max. Marks
1	Tests (A)	3	60%	18
2	Alternate Assessment Tools (AAT) (B)	3	40%	12
	Total Marks for theory component A+B			**30**

CIE for the LAB component: 20 Marks

On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.

The laboratory test (duration 02/03 hours) at the end of the 14^{th} /15^{th} week of the semester / after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 20 marks.

Final CIE Marks (Maximum) for IC Courses = 30 + 20 = 50
SEE for IC Theory for 3 hours duration

The question paper will have ten questions. Each question is set for 20 marks.

There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)

The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IC, the total marks of all questions should not be more than the 30 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources: -

Books (Title of the Book / Name of the author / Name of the publisher / Edition and Year)

Text Books:

B.S.Grewal: "Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021
E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.

Reference Books:

V.Ramana: "Higher Engineering Mathematics "McGraw-Hill Education, 11th Ed., 2017
Srimanta Pal & Subodh C. Bhunia: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.

Semester: I/II

Course Title: Physics for Computer Science and Engineering stream

Course Code:	**22PHYS12/22**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:2:2:0	Exam Hours	03+02
Total Hours of Pedagogy	40 hours Theory + 10-12 Lab Slots	Credits	04

Module - 1	8 Hours

Quantum Mechanics:
de Broglie Hypothesis and Matter Waves, de Broglie wavelength and derivation of expression by analogy, Phase Velocity and Group Velocity (Derivation), Heisenberg's Uncertainty Principle and its application (Nonexistence of electron inside the nucleus-Non Relativistic), Principle of Complementarity, Time independent Schrodinger wave equation, Wave Function, Physical Significance of a wave function and Max Born Interpretation (Probability density), Normalization of wave function, Expectation value, Eigen Values and Eigen functions, Application of Schrodinger equation: Particle inside one-dimensional infinite potential well, Energy Eigen values and normalized Eigen Wave function.
Numerical problems: de Broglie Hypothesis, Heisenberg's Uncertainty Principle, One dimensional potential well.
Pre-requisite: Wave-Particle dualism
Self-learning: de Broglie Hypothesis

Module - 2	8 Hours

Photonics:
LASER: Metastable State, Interaction of Radiation with Matter, Einstein's Coefficients (A and B), Requisites of a laser system Laser Action: Population Inversion, Semiconductor Diode Laser, Properties of LASER beam, Applications: Bar code scanner, Laser Printer.
Optical Fiber: Principle and structure, Acceptance angle and acceptance cone, Numerical Aperture (NA) and Derive the expression for NA, Classification of Optical Fibers, Optical fiber Losses, Attenuation coefficient (Derivation), Applications: Fiber Optic networking, Fiber Optic Communication.
Numerical Problems: Power of LASER, Papulation inversion, Numerical aperture, Attenuation coefficient.
Pre-requisite: Properties of light, Wave guides
Self-learning: Laser cooling application, Propagation Mechanism (Optical Fibers)

Module - 3	8 Hours

Electrical Properties of Materials and Superconductors:
Electrical Properties of Materials: Electrical conductivity in metals (Classical free electron theory), Mobility and Resistivity (Conductivity), Concept of Phonon, Matthiessen's rule, failures of classical free electron theory.
Superconductors: Introduction to Super Conductors, Temperature dependence of resistivity, Meissner's Effect, Silsbee Effect, Types of Superconductors, Temperature dependence of critical field, BCS theory (Qualitative), High-Temperature superconductivity, Quantum Tunneling and Josephson Junction (Qualitative), Applications: Maglev vehicle and SQUIDs.
Numerical problems: Mobility and resistivity, Critical field of superconductor
Pre-requisites: Basics of Electrical conductivity
Self-learning: Definitions of Resistance, Resistivity, Conductivity and Mobility

Module - 4	8 Hours

Applications of Physics in Animation:
Physics of Animation: Taxonomy of physics-based animation methods, Frames, Frames per Second, Size and Scale, weight and strength, Motion and Timing in Animations, Constant Force and Acceleration, The Odd rule, Motion Graphs, Numerical Calculations based on Odd Rule, Examples of Character Animation: Jumping, Walking. Numerical problems.
Statistical Physics for Computing: Descriptive statistics and inferential statistics, Poisson distribution and Normal Distributions (Bell Curves), Monte Carlo Method.
Numerical problems: Frames, Jumping, Statistical computing
Pre-requisites: Motion in one dimension

Self-learning: Frames, Frames per Second

Module - 5 **8 Hours**

Quantum Computing:
Principles of Quantum Information & Quantum Computing: Introduction to Quantum Computing, Moore's law & its end. Single particle quantum interference, Quantum entanglement (Qualitative), Classical & quantum information comparison. Differences between classical & quantum computing, quantum superposition and the concept of qubit.
Properties of a qubit: Mathematical representation. Summation of probabilities, Representation of qubit by Bloch sphere
Quantum Gates: Single Qubit Gates: Quantum Not Gate, Pauli -Z Gate Hadamard Gate, Pauli Matrices, Phase Gate (or S Gate), T Gate, Multiple Qubit Gates: Controlled gate, CNOT Gate, (Discussion for 4 different input states). Representation of, Swap gate, Controlled-Z gate, Toffoli gate, Accounting for the extra-ordinary capability of quantum computing, Model Realizations.
Pre-requisites: Introduction to Matrices.
Self-learning: Moore's law

Course outcome
At the end of the course the student will be able to:

CO1	**Discuss** the basic principles of Quantum Mechanics and their application.
CO2	**Describe** the principles of LASERS and Optical fibers and their relevant applications.
CO3	**Summarize** the electrical properties and superconductors with applications.
CO4	**Illustrate** the application of physics of animation in design and data analysis. **Elucidate** fundamentals of quantum computing and applications
CO5	**Practice** working in groups to conduct experiments in Physics and **perform** precise and honest measurements.

Suggested Learning Resources:
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)
1. Solid State Physics, S O Pillai, New Age International Private Limited, 8th Edition, 2018.
2. Engineering Physics by Gupta and Gour, Dhanpat Rai Publications, 2016 (Reprint).
3. Concepts of Modern Physics, ArthurBeiser, McGraw-Hill, 6th Edition, 2009.
4. Lasers and Non-Linear Optics, B B Loud, New age international, 2011 edition.
5. A textbook of Engineering Physics by M .N. Avadhanulu, P G. Kshirsagar and T V S Arun Murthy, Eleventh edition, S Chand and Company Ltd. New Delhi-110055.
6. Quantum Computation and Quantum Information, Michael A. Nielsen & Isaac L. Chuang, Cambridge Universities Press, 2010 Edition.
7. Quantum Computing, Vishal Sahani, McGraw Hill Education, 2007 Edition.
8. Engineering Physics, S P Basavaraj, 2005 Edition,
9. Physics for Animators, Michele Bousquet with Alejandro Garcia, CRC Press, Taylor & Francis, 2016.
10. Quantum Computation and Logic: How Quantum Computers Have Inspired Logical Investigations, Maria Luisa Dalla Chiara, Roberto Giuntini, Roberto Leporini, Giuseppe Sergioli, Trendsin Logic, Volume 48, Springer.
11. Statistical Physics: Berkely Physics Course, Volume 5, F. Reif, McGraw Hill.
12. Introduction to Superconductivity, Michael Tinkham, McGraww Hill, INC, II Edition

Laboratory Component:
Any Ten Experiments have to be completed from the list of experiments
Note: The experiments have to be classified into

Exercise, b) Demonstration, c) Structured Inquiry, d) Open Ended

Based on the convenience classify the following experiments into the above categories. Select at least one simulation/spreadsheet activity.

List of Experiments:
1. Wavelength of Hg – Source using Grating
2. Numerical Aperture using optical fiber
3. Four Probe Method

4. Transistor Characteristics
5. Charging and Discharging of a Capacitor
6. Photo-Diode Characteristics
7. Series & Parallel LCR
8. Magnetic Field at any point along the axis of a circular coil
9. Plank's Constant using LEDs
10. Fermi Energy
11. Black Box
12. Energy gap of a given semiconductor
13. GNU Step Interactive Simulations
14. Study of motion using spread Sheets
15. Application of Statistic using Spread Sheets
16. PHET Interactive Simulations

Assessment Details

CIE for the Theory component: 30 Marks

	Components	Number	Weightage	Max. Marks
1	Tests (A)	3	60%	18
2	Alternate Assessment Tools(AAT) (B)	3	40%	12
	Total Marks for theory component A+B			30

CIE for the LAB component: 20 Marks

On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.

The laboratory test (duration 02/03 hours) at the end of the 14th /15th week of the semester / after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 20 marks.

Final CIE Marks (Maximum) for IC Courses = 30 + 20 = 50

SEE for IC Theory for 3 hours duration

The question paper will have ten questions. Each question is set for 20 marks.

There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)

The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IC, the total marks of all questions should not be more than the 30 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Semester: I/II

Course Title: Chemistry for Computer Science & Engineering Stream

Course Code:	**22CHES12/22**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:2:2:0	Exam Hours	03+02
Total Hours of Pedagogy	40 hours Theory + 10-12 Lab Slots	Credits	04

MODULE 1: Sensors and Energy Systems (8hr)

Sensors: Introduction, working principle and applications of Conductometric sensors, Electrochemical sensors, Thermometric sensors, and Optical sensors. Sensors for the measurement of dissolved oxygen (DO). Electrochemical sensors for the pharmaceuticals, surfactants, hydrocarbons. Electrochemical gas sensors for SOx and NOx. Disposable sensors in the detection of biomolecules and pesticides.
Energy Systems: Introduction to batteries, construction, working and applications of Lithium ion and Sodium ion batteries. **Fuel cells:** Introduction, limitations and advantages. Construction, working and applications of methanol-oxygen fuel cells,
Self-learning: Types of electrochemical sensor, Gas sensor - O_2 sensor, Biosensor - Glucose sensors.

MODULE 2: Materials for Memory and Display Systems (8hr)

Memory Devices: Introduction, Basic concepts of electronic memory, History of organic / polymer electronic memory devices, Classification of electronic memory devices, types of organic memory devices (organic molecules, polymeric materials, organic- inorganic hybrid materials).
Display Systems: Photoactive and electroactive materials, Nanomaterials and organic materials used in optoelectronic devices. Liquid crystals (LC's) - Introduction, classification, properties and application in Liquid Crystal Displays (LCD's). Properties and application of Organic Light Emitting Diodes (OLED's) and Quantum Light Emitting Diodes (QLED's), Light emitting electrochemical cells.
Self-learning: Properties and functions of Silicon (Si), Germanium (Ge), Copper (Cu), Aluminium (Al), and Brominated flame retardants in computers.

MODULE 3: Corrosion and Electrode System (8hr)

Corrosion Chemistry: Introduction, electrochemical theory of corrosion, types of corrosion-differential metal and differential aeration. Corrosion control - galvanization, anodization and sacrificial anode method. Corrosion Penetration Rate (CPR) - Introduction and numerical problem.
Electrode System: Introduction, types of electrodes. Reference electrode - Introduction, calomel electrode – construction, working and applications of calomel electrode ion selective electrode – definition, construction, working and applications of glass electrode. Determination of pH using glass electrode. Concentration cell– Definition, construction and Numerical problems.
Analytical Techniques: Introduction, principle and instrumentation of Conductometry; its application in the estimation of weak acid. Potentiometry; its application in the estimation of iron.
Self-learning: IR and UV- Visible spectroscopy.

MODULE 4: Polymers and Green Fuels (8hr)

Polymers: Introduction, Molecular weight - Number average, weight average and numerical problems. Conducting polymers – synthesis and conducting mechanism of polyacetylene and commercial applications. Preparation, Properties and applications of Kevlar
Green Fuels: Introduction, construction and working of solar photovoltaic cell, advantages, and disadvantages. Generation of energy (green hydrogen) by electrolysis of water and its advantages.
Self-learning: Regenerative fuel cells

MODULE 5: E-Waste Management (8hr)

PRACTICAL MODULE

A – Demonstration (any two) offline/virtual:
A1. Chemical Structure drawing using software: ChemDraw or ACD/ChemSketch
A2. Determination of strength of an acid in Pb-acid battery
A3: Synthesis of Iron-oxide Nanoparticles

A4. Electrolysis of water
B – Exercise (compulsorily any 4 to be conducted): B1. Conductometric estimation of acid mixture B2. Potentiometric estimation of FAS using $K_2Cr_2O_7$ B3. Determination of pKa of vinegar using pH sensor (Glass electrode) B4. Determination of rate of corrosion of mild steel by weight loss method B5. Estimation of total hardness of water by EDTA method ***C – Structured Enquiry (compulsorily any 4 to be conducted):*** C1. Estimation of Copper present in electroplating effluent by optical sensor (colorimetry) C2. Determination of Viscosity coefficient of lubricant (Ostwald's viscometer) C3. Estimation of iron in TMT bar by diphenyl amine/external indicator method C4. Estimation of Sodium present in soil/effluent sample using flame photometry C5. Determination of Chemical Oxygen Demand (COD) of industrial waste water sample ***D – Open Ended Experiments (any two):*** D1: Evaluation of acid content in beverages by using pH sensors and simulation. D2. Construction of photovoltaic cell. D3. Design an experiment to Identify the presence of proteins in given sample. D4. Searching suitable PDB file and target for molecular docking

Course outcome

At the end of the course the student will be able to:

CO1	Explain working principle and applications of sensors and construction, working of batteries and fuel cells.
CO2	Identify, explain properties and applications of different memory devices and display systems.
CO3	Implement the knowledge of corrosion chemistry for corrosion control and Solve for the problems in chemistry pertinent in engineering applications using electrode systems and analytical techniques
CO4	Analyze the properties and applications of polymers for engineering applications and explain construction and working of PV cells.
CO5	Identify sources, composition, characteristics, and health hazards of e-wastes, their recycling and recovery.

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Wiley Engineering Chemistry, Wiley India Pvt. Ltd. New Delhi, 2013- 2nd Edition.
2. Engineering Chemistry, Satyaprakash & Manisha Agrawal, Khanna Book Publishing, Delhi
3. A Text Book of Engg. Chemistry, Shashi Chawla, Dhanpat Rai & Co. (P) Ltd.
4. Essentials of Physical Chemistry, Bahl&Tuli, S.Chand Publishing
5. Applied Chemistry, Sunita Rattan, Kataria 5. Engineering Chemistry, Baskar, Wiley
6. Engineering Chemistry – I, D. Grour Krishana, Vikas Publishing
7. A Text book of Engineering Chemistry, SS Dara & Dr. SS Umare, S Chand & Company Ltd., 12th Edition, 2011.
8. A Text Book of Engineering Chemistry, R.V. Gadag and Nityananda Shetty, I. K. International Publishing house. 2nd Edition, 2016.
9. Text Book of Polymer Science, F.W. Billmeyer, John Wiley & Sons, 4th Edition, 1999.
10. Nanotechnology A Chemical Approach to Nanomaterials, G.A. Ozin & A.C. Arsenault, RSC Publishing, 2005.
11. Corrosion Engineering, M. G. Fontana, N. D. Greene, McGraw Hill Publications, New York, 3rd Edition, 1996.
12. Linden's Handbook of Batteries, Kirby W. Beard, Fifth Edition, McGraw Hill, 2019.
13. OLED Display Fundamentals and Applications, Takatoshi Tsujimura, Wiley–Blackwell , 2012
14. Supercapacitors: Materials, Systems, and Applications, Max Lu, Francois Beguin, Elzbiet Frackowiak, Wiley-VCH; 1st edition, 2013.
15. "Handbook on Electroplating with Manufacture of Electrochemicals", ASIA PACIFIC BUSINESS PRESS Inc., 2017. Dr. H. Panda,
16. Expanding the Vision of Sensor Materials. National Research Council 1995, Washington, DC: The National Academies Press. doi: 10.17226/4782.
17. Engineering Chemistry, Edited by Dr. Mahesh B and Dr. Roopashree B, Sunstar Publisher, Bengaluru, ISBN 978-93-85155-70-3, 2022
18. High Performance Metallic Materials for Cost Sensitive Applications, F. H. Froes, et al. John Wiley & Sons, 2010
19. Instrumental Methods of Analysis, Dr. K. R. Mahadik and Dr. L. Sathiyanarayanan, Nirali Prakashan, 2020

20. Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, Stanley R. Crouch Seventh Edition, Cengage Learning, 2020
21. Polymer Science, V R Gowariker, N V Viswanathan, Jayadev, Sreedhar, Newage Int. Publishers, 4th Edition, 2021
22. Engineering Chemistry, P C Jain & Monica Jain, Dhanpat Rai Publication, 2015-16th Edition.
23. Nanostructured materials and nanotechnology, Hari Singh, Nalwa, academic press, 1st Edition, 2002.
24. Nanotechnology Principles and Practices, Sulabha K Kulkarni, Capital Publishing Company, 3rd Edition 2014
25. Principles of nanotechnology, Phanikumar, Scitech publications, 2nd Edition, 2010.
26. Chemistry for Engineering Students, B. S. Jai Prakash, R. Venugopal, Sivakumaraiah & Pushpa Iyengar., Subash Publications, 5th Edition, 2014
27. "Engineering Chemistry", O. G. Palanna, Tata McGraw Hill Education Pvt. Ltd. New Delhi, Fourth Reprint, 2015.
28. Chemistry of Engineering materials, Malini S, K S Anantha Raju, CBS publishers Pvt Ltd.,
29. Laboratory Manual Engg. Chemistry, Anupma Rajput, Dhanpat Rai & Co.

Assessment Details

CIE for the Theory component: 30 Marks

	Components	Number	Weightage	Max. Marks
1	Tests (A)	3	60%	18
2	Alternate Assessment Tools(AAT) (B)	3	40%	12
	Total Marks for theory component A+B			30

CIE for the LAB component: 20 Marks

On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.

The laboratory test (duration 02/03 hours) at the end of the 14th /15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for20 marks.

Final CIE Marks (Maximum) for IC Courses = 30 + 20 = 50

SEE for IC Theory for 3 hours duration

The question paper will have ten questions. Each question is set for 20 marks.

There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)

The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IC, the total marks of all questions should not be more than the 30 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Semester: I/II

Course Title: Principles of Programming using C

Course Code:	**22POP13/23**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:0:2	Exam Hours	03+02
Total Hours of Pedagogy	40 hours Theory + 10-12 Lab Slots	Credits	03

Module-1	**8 Hours**
Introduction to C: Introduction to computers, input and output devices, designing efficient programs. Introduction to C, Structure of C program, Files used in a C program, Compilers, Compiling and executing C programs, variables, constants, Input/output statements in C, **Textbook: Chapter 1.1-1.□, 2.1-2.2, 8.1 - 8.6, □.1-□.14**	
Teaching- Learning Process	Chalk and talk method/Power Point Presentation/ Web Content: https://tinyurl.com/4xmrexre
Module-2	**8 Hours**
Operators in C, Type conversion and typecasting.	
Decision control and Looping statements: Introduction to decision control statements, Conditional branching statements, iterative statements, nested loops, break and continue statements, goto statement. **Textbook: Chapter □.15-□.16, 10.1-10.6**	
Teaching- Learning Process	Chalk and talk method/ Power Point Presentation
Module-3	**8 Hours**
Arrays: Declaration of arrays, accessing the elements of an array, storing values in arrays, Operations on arrays, Passing arrays to functions, two dimensional arrays, operations on two- dimensional arrays, two- dimensional arrays to functions, multidimensional arrays, applications of arrays. **Functions:** Introduction to functions, Function definition, function declaration, function call, return statement, passing parameters to functions, scope of variables, storage classes, recursive functions. **Textbook: Chapter 11.1-11.10, 12.1-12.10,12.12**	
Teaching- Learning Process	Chalk and talk method/ Power Point Presentation
Module-4	**8 Hours**
Strings and Pointers: Introduction to string, operations on strings, Miscellaneous string and character functions, arrays of strings. Pointers: Introduction to pointers, declaring pointer variables, Types of pointers, passing arguments to functions using pointers **Textbook: Chapter 13.1-13.6, 14-14.7**	
Teaching- Learning Process	Chalk and talk method/ Power Point Presentation
Module-5	**8 Hours**
Structure, Union, and Enumerated Data Type: Introduction, structures and functions, Unions, unions inside structures, Enumerated data type. Files: Introduction to files, using files in C, reading and writing data files., Detecting end of file **Textbook: Chapter 15.1 – 15.10, 16.1-16.5**	
Teaching- Learning Process	Chalk and talk method/ Power Point Presentation

Course Outcomes:
At the end of the course the student will be able to:

1. Identify and name the hardware components of Computer.
2. Apply programming constructs of C language to solve the real world problem
3. Write a program to emphasis use of arrays by implementing solutions to problems like searching and sorting
4. Write a program to emphasis uses of structures, pointers and files to implement solutions to the problems.
5. Design and Develop Solutions to problems using modular programming constructs.

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Programming Assignments

1. Simulation of a Simple Calculator.
2. Compute the roots of a quadratic equation by accepting the coefficients. Print appropriate messages.
3. An electricity board charges the following rates for the use of electricity: for the first 200 units 80 paise per unit: for the next 100 units 90 paise per unit: beyond 300 units Rs 1 per unit. All users are charged a minimum of Rs. 100 as meter charge. If the total amount is more than Rs 400, then an additional surcharge of 15% of total amount is charged. Write a program to read the name of the user, number of units consumed and print out the charges
4. Write a C Program to display the following by reading the number of rows as input,

```
       1
     1 2 1
   1 2 3 2 1
 1 2 3 4 3 2 1
□□□□□□□□□□□□□□□□□□□□□
    nth row
```

5. Implement Binary Search on Integers.
6. Implement Matrix multiplication and validate the rules of multiplication.
7. Compute sin(x)/cos(x) using Taylor series approximation. Compare your result with the built-in library function. Print both the results with appropriate inferences.
8. Sort the given set of N numbers using Bubble sort.
9. Write functions to implement string operations such as compare, concatenate, and find string length. Use the parameter passing techniques.
10. Implement structures to read, write and compute average- marks of the students, list the students scoring above and below the average marks for a class of N students.
11. Develop a program using pointers to compute the sum, mean and standard deviation of all elements stored in an array of N real numbers.
12. Write a C program to copy a text file to another, read both the input file name and target file name.

Note:

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. OR based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Students can pick one experiment from the questions lot with equal choice to all the students in a batch. Student should develop an algorithm, program, execute and demonstrate the results with appropriate output for the given problem.

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 02 hours

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). The minimum passing mark for the SEE is 35% of the maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation(CIE):
Two Unit Tests each of20 Marks (duration 01 hour)

First test after the completion of 30-40 % of the syllabus
Second test after completion of 80-90% of the syllabus

One Improvement test before the closing of the academic term may be conducted if necessary. However best two tests out of three shall be taken into consideration.

Two assignments each of 10 Marks
The teacher has to plan the assignments and get them completed by the students well before the closing of the term so that marks entry in the examination portal shall be done in time. Formative (Successive) Assessments include Assignments/Quizzes/Seminars/ Course projects/Field surveys/ Case studies/ Hands-on practice (experiments)/Group Discussions/ others. The Teachers shall choose the types of assignments depending on the requirement of the course and plan to attain the Cos and POs. (to have a less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course). CIE methods /test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

The sum of two tests, two assignments, will be out of 60 marks and will be scaled down to 30 marks CIE for the practical component of the Integrated Course
On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The **15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and **scaled down to 15 marks**.
The laboratory test **(duration 02/03 hours)** at the end of the 14th /15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and **scaled down to 05 marks.**
Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

Semester End Examination (SEE):

SEE for IC
Theory SEE will be conducted by University as per the scheduled time table, with common question papers for the course (duration 03 hours)
1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the Integrated Course shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component).
Passing standard:

The minimum marks to be secured in CIE to appear for SEE shall be 12 (40% of maximum marks30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than 30 marks.
SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify for the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:
Textbooks
1. Computer fundamentals and programming in c, "Reema Thareja", Oxford University, Second edition, 2017.

Reference Books:
1. E. Balaguruswamy, Programming in ANSI C, 7th Edition, Tata McGraw-Hill.
2. Brian W. Kernighan and Dennis M. Ritchie, The C' Programming Language, Prentice Hall of India

Semester: II

Course Title: Mathematics for CSE Stream-II

Course Code:	**22MATS21**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:2:2:0	Exam Hours	03+02
Total Hours of Pedagogy	40 hours Theory + 10-12 Lab Slots	Credits	04

PRE REQUISITES:

Dot and Cross product of vectors, differentiation and Integration
Definition of Differential Equations, method of solving first order differential equations.
Concept of partial differentiation. Formation of differential equation.
Solving quadratic, cubic equations
Solving first order and first degree differential equation analytically.

Module-1 Vector Calculus — **8 hours**

Scalar and vector fields. Gradient, directional derivative, curl and divergence - physical interpretation, solenoidal and irrotational vector fields. Problems.
Curvilinear coordinates: Scale factors, base vectors, Cylindrical polar coordinates, Spherical polar coordinates, transformation between cartesian and curvilinear systems, orthogonality. Problems.

Self-Study: Volume integral and Gauss divergence theorem.
Applications: Conservation of laws, Electrostatics, Analysis of stream lines.
(RBT Levels: L1, L2 and L3)

Module-2 Ordinary Differential Equations of higher order — **8 hours**

Higher-order linear ODE's with constant coefficients - Inverse differential operator, method of variation of parameters, Cauchy's and Legendre homogeneous differential equations. Problems.

Self-Study: Formulation and solution of oscillations of a spring. Finding the solution by the method of undetermined coefficients.
Applications: L-C–R Circuit
(RBT Levels: L1, L2 and L3)

Module-3 Laplace Transform — **8 hours**

Existence and Uniqueness of Laplace transform (LT), transform of elementary functions, region of convergence, Properties–Linearity, Scaling, t-shift property, s-domain shift, differentiation in the s- domain, division by t, differentiation and integration in the time domain, LT of special functions- periodic functions (square wave, saw-tooth wave, triangular wave, full & half wave rectifier), Heaviside Unit step function.
Inverse Laplace Transforms:
Definition, properties, evaluation using different methods, convolution theorem (without proof), problems, and Applications to solve ordinary differential equations.
Self-Study: Unit impulse function, Verification of convolution theorem.
Applications: Half Wave, full wave rectifiers and control theory, evaluation of differential equations.
(RBT Levels: L1, L2 and L3)

Module-4 Numerical methods -1 — **8 hours**

Solution of algebraic and transcendental equations - Regula-Falsi and Newton-Raphson methods (only formulae). Problems.
Finite differences, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference formula and Lagrange's interpolation formula (All formulae without proof). Problems.
Numerical integration: Trapezoidal, Simpson's $(1/3)^{rd}$ and $(3/8)^{th}$ rules (without proof). Problems.

Self-Study: Ramanujan's method, Bisection method, Lagrange's inverse Interpolation, Weddle's rule.
Applications: Estimating the approximate roots, extremum values, Area, volume, surface area. Errors in finite precision.

(RBT Levels: L1, L2 and L3)

Module-5 Numerical methods -2	8 hours
Numerical Solution of Ordinary Differential Equations (ODE's): Numerical solution of ordinary differential equations of first order and first degree - Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor-corrector formula (No derivations of formulae). Problems. **Self-Study:** Adam-Bashforth method. **Applications:** Estimating the approximate solutions of ODE. **(RBT Levels: L1, L2 and L3).**	

List of Laboratory experiments (2 hours/week per batch/ batch strength 15)
10 lab sessions + 1 repetition class + 1 Lab Assessment

1	Finding gradient, divergent, curl and their geometrical interpretation
2	Solution of second order differential equations
3	Find the Laplace Transform of some standard functions
4	Find the Inverse Laplace Transform of some standard functions
5	Solution of algebraic and transcendental equation by Ramanujan's, Regula-Falsi and Newton-Raphson method
6	Interpolation/Extrapolation using Newton's forward and backward difference formula
7	Computation of area under the curve using Trapezoidal, Simpson's $(1/3)^{rd}$ and $(3/8)^{th}$ rule
8	Develop a program to solve ODE of first order and first degree by Taylor's series and Modified Euler's method
9	Develop a program to solve ODE of first order and first degree by R-K 4^{th} order method
10	Develop a program to solve ODE of first order and first degree by Milne's predictor-corrector method

Suggested software's: Mathematica/MatLab/Python/Scilab

COURSE OUTCOMES:

CO1	Apply concept of vector calculus to solenoidal, irrotational vectors, Orthogonal curvilinear coordinates.
CO2	Demonstrate various physical models through higher order differential equations and solve such linear ordinary differential equations.
CO3	Solve differential /integral equation arising in network analysis, control systems and other fields of engineering using Laplace Transform and inverse Laplace Transform.
CO4	Apply the knowledge of numerical methods in analysing the discrete data and for solving the physical and engineering problems.
CO5	Solve first order ODE arising in flow data design problems using appropriate single and multi-step numerical methods.

Assessment Details

CIE for the Theory component: 30 Marks

	Components	Number	Weightage	Max. Marks
1	Tests (A)	3	60%	18
2	Alternate Assessment Tools (AAT) (B)	3	40%	12
	Total Marks for theory component A+B			**30**

CIE for the LAB component: 20 Marks

On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.

The laboratory test (duration 02/03 hours) at the end of the 14^{th} /15^{th} week of the semester / after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 20 marks.

Final CIE Marks (Maximum) for IC Courses = 30 + 20 = 50
SEE for IC Theory for 3 hours duration

The question paper will have ten questions. Each question is set for 20 marks.

There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)

The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IC, the total marks of all questions should not be more than the 30 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year) Text Books

1. B. S. Grewal: "Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021.
2. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.

Reference Books

1. V. Ramana: "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed., 2017
2. Srimanta Pal & Subodh C. Bhunia: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
3. N.P Bali and Manish Goyal: "A textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
4. C. Ray Wylie, Louis C. Barrett: "Advanced Engineering Mathematics" McGraw – Hill Book Co., Newyork, 6th Ed., 2017.
5. Gupta C.B, Sing S.R and Mukesh Kumar: "Engineering Mathematic for Semester I and II", Mc-Graw Hill Education (India) Pvt. Ltd 2015.
6. H. K. Dass and Er. Rajnish Verma: "Higher Engineering Mathematics" S. Chand Publication, 3rd Ed., 2014.
7. James Stewart: "Calculus" Cengage Publications, 7th Ed., 2019.
8. David C Lay: "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018.
9. Gareth Williams: "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6th Ed., 2017.

** ** **

ELECTRICAL ENGINEERING STREAMS

1st / 2nd Semester Scheme and Syllabus
(Effective from the academic year 2022-23)

Scheme of Teaching and Examinations-2022
Outcome-Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2022-23)

I Semester (Electrical & Electronics Engineering Stream) **(For Physics Group)**

SN	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	*ASC(IC)	**22MATE11	Mathematics for EEE Streams-I	Maths	2	2	2	0	03	50	50	100	04
2	#ASC(IC)	22PHYE12	Physics for EEE Stream	PHY	2	2	2	0	03	50	50	100	04
3	ESC	22EEE13	# Element of Electrical Engineering	EEE/ECE/TCE	2	2	0	0	03	50	50	100	03
		OR											
		22BEE13	## Basic Electronics		3	0	0	0					
4	ESC-I	22ESC14x	Engineering Science Course-I	Respective Engg Dept.	3	0	0	0	03	50	50	100	03
5	ETC-I	22ETC15x	Emerging Technology Course-I	Any Dept.	3	0	0	0	03	50	50	100	03
	OR												
	PLC-I	22PLC15x	Programming Language Course-I		2	0	2	0	03				
6	AEC	22ENG16	Communicative English	Humanities	1	0	0	0	01	50	50	100	01
7	HSMC	22KSK17/ 22KBK17	Samskrutika Kannada/ Balake Kannada	Humanities	1	0	0	0	01	50	50	100	01
		OR											
		22ICO17	Indian Constitution										
8	AEC/SDC	22IDT18	Innovation and Design Thinking	Any Dept.	1	0	0	0	01	50	50	100	01
		OR			OR								
		22SFH18	Scientific Foundations of Health		1	0	0	0	01				
				TOTAL						**400**	**400**	**800**	**20**

SDA-Skill Development Activities, **TD/PSB**- Teaching Department / Paper Setting Board, **ASC**-Applied Science Course, **ESC**- Engineering Science Courses, **ETC**- Emerging Technology Course, **AEC**- Ability Enhancement Course, HSMS-Humanity and Social Science and management Course, SDC- Skill Development Course, **CIE** –Continuous Internal Evaluation, **SEE**- Semester End Examination, **IC** – Integrated Course (Theory Course Integrated with Practical Course)

Credit Definition:
1-hour Lecture (L) per week=**1Credit**
2-hoursTutorial(T) per week=**1Credit**
2-hours Practical / Drawing (P) per week=**1Credit**
2-hous Skill Development Actives (SDA) per week = **1 Credit**

04-Credits courses are to be designed for 50 hours of Teaching-Learning Session 04-Credits (IC) are to be designed for 40 hours' theory and 12-14 hours of practical sessions
03-Credits courses are to be designed for 40 hours of Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 12-15 hours of Teaching-Learning sessions

Student's Induction Program: Motivating (Inspiring) Activities under the Induction program – The main aim of the induction program is to provide newly admitted students a broad understanding of society, relationships, and values. Along with the knowledge and skill of his/her study, students' character needs to be nurtured as an essential quality by which he/she would understand and fulfill the responsibility as an engineer. The following activities are to be covered in 21 days. Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to Local areas, Familiarization with Department/Branch and Innovation, etc. For details, refer the ANNEXUREI of Induction Programs notification of the University published at the beginning of the 1st semester.

AICTE Activity Points to be earned by students admitted to BE/ B.Tech., / B. Plan day college program (For more details refer to Chapter 6, AICTE Activity Point Program, Model Internship Guidelines): Over and above the academic grades, every regular student admitted to the 4 years Degree program and every student entering 4 years Degree programs through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Program. Students transferred from other Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, any time during the semester weekends, and holidays, as per the liking and convenience of the student from the year of entry to the program. However, the minimum hour's requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, an Eighth Semester Grade Card shall be issued only after earning the required activity points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

***-22MATC11** Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory question papers ** **The mathematics subject should be taught by a single faculty member per division, with no sharing of the course(subject)module-wise by different faculty members.**
#-22PHYC12 SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination
ESC or ETC of 03 Credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature of the course required practical learning then the syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0).
All 01 Credit- courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

(ESC-I) Engineering Science Courses-I					(ETC-I) Emerging Technology Courses-I				
Code	Title	L	T	P	Code	Title	L	T	P
22ESC141	Introduction to Civil Engineering	3	0	0	22ETC15A	Smart materials and Systems	3	0	0
22ESC142	Introduction to Electrical Engineering	3	0	0	22ETC15B	Green Buildings	3	0	0
22ESC143	Introduction to Electronics Engineering	3	0	0	22ETC15E	Renewable Energy Sources	3	0	0
22ESC144	Introduction to Mechanical Engineering	3	0	0	22ETC15F	Drone technology	3	0	0
22ESC145	Introduction to C Programming	2	0	2	22ETC15G	Introduction to Sustainable Engineering	3	0	0
					22ETC15H	Introduction to Internet of Things(IoT)	3	0	0
					22ETC15I	Waste Management	3	0	0
					22ETC15J	Introduction to Cyber Security	3	0	0
(PLC-I) Programming Language Courses-I									
Code	Title	L	T	P					
22PLC15A	Introduction to Web Programming	2	0	2					
22PLC15B	Introduction to Python Programming	2	0	2					
22PLC15C	Basics of JAVA programming	2	0	2					
22PLC15D	Introduction to C++ Programming	2	0	2					
The course 22ESC145/245, Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT									

- The student has to select one course from the ESC-I group.
- **EEE** Students shall opt for any one of the courses from the ESC-I group **except, 22ESC142-Introduction to Electrical Engineering** and **ECE/ETC/BM/ML** students shall opt any one of the courses from ESC-I **except 22ESC143 Introduction to Electronics** Engineering
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-I or PLC-I group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

Scheme of Teaching and Examinations-2022
Outcome-Based Education (OBE) and Choice Based Credit System (CBCS) (Effective from the academic year 2022-23)
II Semester (EEE Stream) (for students who attended I semester under Physics Group)

SN	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week: Theory Lecture	Tutorial	Practical/ Drawing	SDA	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
					L	T	P	S					
1	*ASC(IC)	**22MATE21	Mathematics for EES-II	Maths	2	2	2	0	03	50	50	100	04
2	#ASC(IC)	22CHEE22	Chemistry for EES	Chemistry	2	2	2	0	03	50	50	100	04
3	ESC	22CED23	Computer-Aided Engineering Drawing	Civil / Mech. Engg dept.	2	0	2	0	03	50	50	100	03
4	ESC-II	22ESC24x	Engineering Science Course-II	Respective Engg Dept.	3	0	0	0	03	50	50	100	03
5	PLC-II	22PLC25x	Programming Language Course-II	Any. Dept.	2	0	2	0	03	50	50	100	03
	OR												
	ETC-II	22ETC25x	Emerging Technology Course-II		3	0	0	0	03				
6	AEC	22PWS26	Professional Writing Skills in English	Humanities	1	0	0	0	01	50	50	100	01
7	HSMS	22ICO27	Indian Constitution	Humanities	1	0	0	0	01	50	50	100	01
		OR											
		22KSK27 22KBK27	Samskrutika Kannada/ Balake Kannada										
8	HSMS	22SFH28	Scientific Foundations of Health	Any Dept.	1	0	0	0	01	50	50	100	01
			OR						OR				
	HSMS	22ITD29	Innovation and Design Thinking	Any	1	0	0	0	01	50	50	100	
			TOTAL							**400**	**400**	**800**	**20**

SDA-Skill Development Activities, TD/PSB- Teaching Department / Paper Setting Board, ASC-Applied Science Course, ESC- Engineering Science Courses, ETC- Emerging Technology Course, AEC- Ability Enhancement Course, HSMS-Humanity and Social Science and management Course, SDC- Skill Development Course,
CIE -Continuous Internal Evaluation, SEE- Semester End Examination, IC – Integrated Course (Theory Course Integrated with Practical Course)

Credit Definition: 1-hour Lecture (L) per week=1Credit 2-hoursTutorial(T) per week=1Credit 2-hours Practical / Drawing (P) per week=1Credit 2-hous Skill Development Actives (SDA) per week = 1 Credit	04-Credits courses are to be designed for 50 hours of Teaching-Learning Session 04-Credits (IC) are to be designed for 40 hours' theory and 12-14 hours of practical sessions 03-Credits courses are to be designed for 40 hours of Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 12-15 hours of Teaching-Learning sessions

***-22MAT21** Shall have the 03 hours of theory examination (SEE), however, practical sessions question shall be included in the theory question papers. ** The mathematics subject should be taught by single faculty member per division, with no sharing of the course (subject) module-wise by different faculty members.
#-22CHE22- SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination
ESC or ETC of 03 credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required practical learning syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0).
All 01 Credit- courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

(ESC-II) Engineering Science Courses-II					(ETC-II) Emerging Technology Courses-II				
Code	**Title**	**L**	**T**	**P**	**Code**	**Title**	**L**	**T**	**P**
22ESC241	Introduction to Civil Engineering	3	0	0	22ETC25A	Smart materials and Systems	3	0	0
22ESC242	Introduction to Electrical Engineering	3	0	0	22ETC25B	Green Buildings	3	0	0
22ESC243	Introduction to Electronics Engineering	3	0	0	22ETC25E	Renewable Energy Sources	3	0	0
22ESC244	Introduction to Mechanical Engineering	3	0	0	22ETC25F	Drone technology	3	0	0
22ESC245	Introduction to C Programming	2	0	2	22ETC25G	Introduction to Sustainable Engineering	3	0	0
					22ETC25H	Introduction to Internet of Things(IoT)	3	0	0
					22ETC25I	Waste Management	3	0	0

					22ETC25J	Introduction to Cyber Security	3	0	0
(PLC-II) Programming Language Courses-II									
Code	**Title**	**L**	**T**	**P**					
22PLC25A	Introduction to Web Programming	2	0	2					
22PLC25B	Introduction to Python Programming	2	0	2					
22PLC25C	Basics of JAVA programming	2	0	2					
22PLC25D	Introduction to C++ Programming	2	0	2					
The course 22ESC145/245, Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT									

- The student has to select one course from the ESC-II group.
- **EEE** Students shall opt for any one of the courses from the ESC-I group **except, 22ESC142-Introduction to Electrical Engineering and ECE/ETC/BM/ML** students shall opt any one of the courses from ESC-I **except 22ESC143 Introduction to Electronics** Engineering
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-II or PLC-II group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

Scheme of Teaching and Examinations-2022
Outcome-Based Education (OBE) and Choice Based Credit System (CBCS) (Effective from the academic year 2022-23)
I Semester (EEE Stream) (Chemistry Group)

SN	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	*ASC(IC)	**22MATE 11	Mathematics for EES-I	Maths	2	2	2	0	03	50	50	100	04
2	#ASC(IC)	22CHEE12	Chemistry for EES	Chemistry	2	2	2	0	03	50	50	100	04
3	ESC	22CED13	Computer-Aided Engineering Drawing	Mechanical	2	0	2	0	03	50	50	100	03
4	ESC-I	22ESC14x	Engineering Science Course-I	Respective Dept.	3	0	0	0	03	50	50	100	03
5	ETC-I	22ETC15x	Emerging Technology Course-I	Any Dept.	3	0	0	0	03	50	50	100	03
	OR												
	PLC-I	22PLC15x	Programming Language Course-I		2	0	2	0	03				
6	AEC	22ENG16	Communicative English	Humanities	1	0	0	0	01	50	50	100	01
7	HSMS	22ICO17	Indian Constitution	Humanities	1	0	0	0	01	50	50	100	01
		OR											
		22KSK17/ 22KBK17	Samskrutika Kannada/ Balake Kannada										
8	HSMS	22SFH18	Scientific Foundations of Health	Any Dept.	1	0	0	0	01	50	50	100	01
	OR												
	HSMS	22ITD18	Innovation and Design Thinking	Any Dept.	1	0	0	0	01				
	TOTAL				**15**	**06**	**10**	**00**	**27**	**400**	**400**	**800**	**20**

SDA-Skill Development Activities, TD/PSB- Teaching Department / Paper Setting Board, ASC-Applied Science Course, ESC- Engineering Science Courses, **ETC-** Emerging Technology Course, AEC- Ability Enhancement Course, HSMS-Humanity and Social Science and management Course, **SDC-** Skill Development Course,

CIE -Continuous Internal Evaluation, SEE- Semester End Examination, IC – Integrated Course (Theory Course Integrated with Practical Course)

***22MAT11** Shall have the 03 hours of theory examination (SEE), however, practical sessions question shall be included in the theory question papers. ** The mathematics subject should be taught by single faculty member per division, with no sharing of the course (subject) module-wise by different faculty members.
#-22CHEC12- SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination
ESC or ETC of 03 credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required practical learning syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0).
All 01 Credit- courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

Credit Definition: 1-hour Lecture (L) per week=1Credit 2-hoursTutorial(T) per week=1Credit 2-hours Practical / Drawing (P) per week=1Credit 2-hous Skill Development Actives (SDA) per week = 1 Credit	04-Credits courses are to be designed for 50 hours of Teaching-Learning Session 04-Credits (IC) are to be designed for 40 hours' theory and 12-14 hours of practical sessions 03-Credits courses are to be designed for 40 hours of Teaching-Learning Session 02-Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 12-15 hours of Teaching-Learning sessions

Student's Induction Program: Motivating (Inspiring) Activities under the Induction program – The main aim of the induction program is to provide newly admitted students a broad understanding of society, relationships, and values. Along with the knowledge and skill of his/her study, students' character needs to be nurtured as an essential quality by which he/she would understand and fulfil the responsibility as an engineer. The following activities are to be covered in 21 days. Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to Local areas, Familiarization with Department/Branch and Innovation, etc. For details, refer the ANNEXUREI of Induction Programs notification of the University published at the beginning of the 1st semester.

AICTE Activity Points to be earned by students admitted to BE/ B.Tech., / B. Plan day college program (For more details refer to Chapter 6, AICTE Activity Point Program, Model Internship Guidelines): Over and above the academic grades, every regular student admitted to the 4 years Degree program and every student entering 4 years Degree programs through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Program. Students transferred from other Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, any time during the semester weekends, and holidays, as per the liking and convenience of the student from the year of entry to the program. However, the minimum hour's requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, an Eighth Semester

Grade Card shall be issued only after earning the required activity points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

(ESC-I) Engineering Science Courses-I					(ETC-I) Emerging Technology Courses-I				
Code	**Title**	**L**	**T**	**P**	**Code**	**Title**	**L**	**T**	**P**
22ESC141	Introduction to Civil Engineering	3	0	0	22ETC15A	Smart materials and Systems	3	0	0
22ESC142	Introduction to Electrical Engineering	3	0	0	22ETC15B	Green Buildings	3	0	0
22ESC143	Introduction to Electronics Engineering	3	0	0	22ETC15E	Renewable Energy Sources	3	0	0
22ESC144	Introduction to Mechanical Engineering	3	0	0	22ETC15F	Drone technology	3	0	0
22ESC145	Introduction to C Programming	2	0	2	22ETC15G	Introduction to Sustainable Engineering	3	0	0
					22ETC15H	Introduction to Internet of Things(IoT)	3	0	0
					22ETC15I	Waste Management	3	0	0
					22ETC15J	Introduction to Cyber Security	3	0	0
							3	0	0
(PLC-I) Programming Language Courses-I									
Code	**Title**	**L**	**T**	**P**					
22PLC15A	Introduction to Web Programming	2	0	2					
22PLC15B	Introduction to Python Programming	2	0	2					
22PLC15C	Basics of JAVA programming	2	0	2					
22PLC15D	Introduction to C++ Programming	2	0	2					
The course 22ESC145/245, Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT									

- The student has to select one course from the ESC-I group.
- **EEE** Students shall opt for any one of the courses from the ESC-I group **except, 22ESC142-Introduction to Electrical Engineering and ECE/ETC/BM/ML** students shall opt any one of the courses from ESC-I **except 22ESC143 Introduction to Electronics** Engineering
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-I or PLC-I group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

Scheme of Teaching and Examinations-2022
Outcome-Based Education (OBE) and Choice Based Credit System (CBCS) (Effective from the academic year 2022-23)
II Semester (EEE Stream) (For the students who attended I semester under Chemistry Group)

Sl. No	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	*ASC(IC)	**22MATE21	Mathematics for EES-II	Maths	2	2	2	0	03	50	50	100	04
2	#ASC(IC)	22PHYE22	Physics for EES	PHY	2	2	2	0	03	50	50	100	04
3	ESC	22EEE13	**#** Elements of Electrical Engineering	EEE/ECE/TCE	2	2	0	0	03	50	50	100	03
		OR											
		22BEE13	## Basic Electronics		3	0	0	0					
4	ESC-II	22ESC24x	Engineering Science Course-II	Respective Engg Dept.	3	0	0	0	03	50	50	100	03
5	PLC-II	22PLC25x	Programming Language Course-II	Any Dept.	2	0	2	0	03	50	50	100	03
	OR												
	ETC-II	22ETC25x	Emerging Technology Course-II		3	0	0	0	03				
6	AEC	22PWS26	Professional Writing Skills in English	Humanities	1	0	0	0	01	50	50	100	01
7	HSMC	22KSK27 22KBK27	Samskrutika Kannada/ Balake Kannada	Humanities	1	0	0	0	01	50	50	100	01
		OR											
		22ICO27	Indian Constitution										
8	AEC/SDC	22IDT28	Innovation and Design Thinking	Any Dept.	1	0	0	0	01	50	50	100	01
		OR											
		22SFH28	Scientific Foundations of Health		1	0	0	0					
		TOTAL								**400**	**400**	**800**	**20**

SDA-Skill Development Activities, TD/PSB- Teaching Department / Paper Setting Board, ASC-Applied Science Course, ESC- Engineering Science Courses, ETC- Emerging Technology Course, AEC- Ability Enhancement Course, HSMS-Humanity and Social Science and management Course, SDC- Skill Development Course,
CIE –Continuous Internal Evaluation, SEE- Semester End Examination, IC – Integrated Course (Theory Course Integrated with Practical Course)

-22MATC21** shall have the 03 hours of theory examination (SEE), however, practical sessions question shall be included in the theory question papers. * The mathematics subject should be taught by single faculty member per division, with no sharing of the course (subject) module-wise by different faculty members.**
#-22PHYC22 SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination
ESC or ETC of 03 credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required experimental learning then the syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0). However, there is no SEE for the practical component.
All 01 Credit- courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

(ESC-II) Engineering Science Courses-II					(ETC-II) Emerging Technology Courses-II				
Code	**Title**	**L**	**T**	**P**	**Code**	**Title**	**L**	**T**	**P**
22ESC241	Introduction to Civil Engineering	3	0	0	22ETC25A	Smart materials and Systems	3	0	0
22ESC242	Introduction to Electrical Engineering	3	0	0	22ETC25B	Green Buildings	3	0	0
22ESC243	Introduction to Electronics Engineering	3	0	0	22ETC25E	Renewable Energy Sources	3	0	0
22ESC244	Introduction to Mechanical Engineering	3	0	0	22ETC25F	Drone technology	3	0	0
22ESC245	Introduction to C Programming	2	0	2	22ETC25G	Introduction to Sustainable Engineering	3	0	0
					22ETC25H	Introduction to Internet of Things(IoT)	3	0	0
					22ETC25I	Waste Management	3	0	0
					22ETC25J	Introduction to Cyber Security	3	0	0

(PLC-II) Programming Language Courses-II				
Code	**Title**	**L**	**T**	**P**
22PLC25A	Introduction to Web Programming	2	0	2
22PLC25B	Introduction to Python Programming	2	0	2
22PLC25C	Basics of JAVA programming	2	0	2
22PLC25D	Introduction to C++ Programming	2	0	2

The course 22ESC145/245, Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT

- The student has to select one course from the ESC-II group.
- **EEE** Students shall opt for any one of the courses from the ESC-I group **except, 22ESC242-Introduction to Electrical Engineering and ECE/ETC/BM/ML** students shall opt any one of the courses from ESC**-I except 22ESC243 Introduction to Electronics** Engineering
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-II or PLC-II group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

Semester: I

Course Title: Mathematics for EEE & ECE Stream-I

Course Code:	**22MATE11**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:2:2:0	Exam Hours	03+02
Total Hours of Pedagogy	40 hours Theory + 10-12 Lab Slots	Credits	04

PRE REQUISITES

- Matrices and Determinants.
- Differentiation basic formulae, differentiation of a function of a function
- Differentiation basic formulae, differentiation of a function of a function
- Definition of Differential Equations, Formation of Differential equations, order and degree of a differential equations. Basic formulae of Integration.
- Basic formulae of Integration and evaluation of Definite Integrals

Module-1 Linear Algebra	8 hours
Elementary row transformation of a matrix, Rank of a matrix. Consistency and Solution of system of linear equations - Gauss-Elimination method, Gauss-Jordan method and approximate solution by Gauss-Seidel method. Rayleigh's power method to find the dominant Eigen value and the corresponding Eigenvector. Problems **Self-Study:** Diagonalization of a square matrix of order 2, Solution of system of equations by Gauss-Jacobi iterative method, Inverse of a square matrix by Cayley- Hamilton theorem. **Applications:** Network analysis, Markov Analysis, Critical point of a network system. Optimum solution **(RBT Levels: L1, L2 and L3)**.	
Module-2 Calculus	**8 hours**
Polar coordinates, Polar curves, angle between the radius vector and tangent, angle between two curves. Pedal equation. Curvature and Radius of curvature – Cartesian and Polar forms (with proof). Problems. **Self-study:** Radius of curvature-Parametric form, Center and circle of curvature, evolutes and involutes. **Applications:** Communication signals, Manufacturing of microphones and Image processing. **(RBT Levels: L1, L2 and L3)**	
Module-3 Series Expansion and Multivariable Calculus	**8 hours**
Taylor's series, Maclaurin's series expansion for one variable (Statement only) – problems. Partial differentiation, total derivative - differentiation of composite functions. Jacobian and problems. Maxima and minima for a function of two variables. Problems. **Self-study:** Euler's theorem and problems. Method of Lagrange's undetermined multipliers with single constraint. **Applications:** Series expansion in communication signals, Errors and approximations and vector calculus. **(RBT Levels: L1, L2 and L3)**	
Module-4 Ordinary Differential Equations (ODEs) of first order	**8 hours**
Bernoulli's differential equations. Exact and reducible to exact differential equations - Integrating factors on $\frac{1}{\ }\left(- \ \square\ -\right)$ and $\frac{1}{\ }\left(- \ \square\ -\right)$. Applications of ODE's - Orthogonal Trajectories and L-R circuits. Problems. **Non-linear differential equations:** Introduction to general and singular solutions, Solvable for p only, Clairaut's equations. Problems. **Self-Study:** Applications of ODE's, Solvable for x and y. **Applications:** L-R and C-R circuits, Rate of Growth or Decay, Conduction of heat. **(RBT Levels: L1, L2 and L3)**	
Module-5 Integral Calculus	**8 hours**
Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by changing the order of integration. Applications to find Area and Volume by double and triple integral. Problems. Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions (with proof). Problems. **Self-Study:** Evaluation of double integrals by changing into Polar co-ordinates, Center of gravity, Duplication formula. Reduction formulae **Applications:** Antenna and wave propagation, Calculation of optimum power in electrical circuits, field theory. **(RBT Levels: L1, L2 and L3)**	

List of Laboratory experiments (2 hours/week per batch/ batch strength 15)
10 lab sessions + 1 repetition class + 1 Lab Assessment

1	2D plots for Cartesian and polar curves
2	Finding angle between polar curves, curvature and radius of curvature of a given curve
3	Finding partial derivatives, Jacobian and plotting the graph
4	Applications to Maxima and Minima of two variables
5	Solution of first order differential equation and plotting the graphs
6	Evaluation of Double & Triple Integrals (With and Without Limits)
7	Rank of a Matrix
8	Numerical solution of system of linear equations, test for consistency and graphical representation
9	Solution of system of linear equations using Gauss-Seidel iteration
10	Compute eigenvalues and eigenvectors and find the largest and smallest eigenvalue by Rayleigh power method.

Suggested software's: Mathematica / MatLab / Python/Scilab

COURSE OUTCOMES:

CO1	Apply matrix theory for solving for system of linear equations and compute Eigen values and Eigen vectors
CO2	Apply the knowledge of calculus to solve problems related to polar curves
CO3	Compute rate of change multi variate functions by using the notion of partial differentiation.
CO4	Solve the first order linear/non-linear differential equations analytically using standard methods
CO5	Apply the concept of change the order of the Integration and variables to evaluate multiple integrals and their usage in computing the area and the volumes.

Assessment Details

CIE for the Theory component: 30 Marks

	Components	Number	Weightage	Max. Marks
1	Tests (A)	3	60%	18
2	Alternate Assessment Tools (AAT) (B)	3	40%	12
	Total Marks for theory component A+B			**30**

CIE for the LAB component: 20 Marks

On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.

The laboratory test (duration 02/03 hours) at the end of the 14^{th} /15^{th} week of the semester / after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 20 marks.

Final CIE Marks (Maximum) for IC Courses = 30 + 20 = 50

SEE for IC Theory for 3 hours duration

The question paper will have ten questions. Each question is set for 20 marks.

There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)

The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included.

The maximum of 04/05 questions to be set from the practical component of IC, the total marks of all questions should not be more than the 30 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources: -

Books (Title of the Book / Name of the author / Name of the publisher / Edition and Year)

Text Books:

B.S.Grewal: "Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021
E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.

Reference Books:

V.Ramana: "Higher Engineering Mathematics "McGraw-Hill Education, 11th Ed., 2017
Srimanta Pal & Subodh C. Bhunia: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.

Semester: I/II
(COMMON TO ECE & EEE)

Course Title: Physics for Electrical & Electronics Engineering Stream

Course Code:	**22PHYE12/22**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:2:2:0	Exam Hours	03+02
Total Hours of Pedagogy	40 hours+10-12 Lab Slots	Credits	04

Module-1 **08 Hours**

Quantum Mechanics:
de Broglie Hypothesis and Matter Waves, de Broglie wavelength and derivation of expression by analogy, Phase Velocity and Group Velocity (Derivation), Heisenberg's Uncertainty Principle and its application (Nonexistence of electron inside the nucleus-Non Relativistic), Principle of Complementarity, Time independent Schrodinger wave equation, Wave Function, Physical Significance of a wave function and Max Born Interpretation (Probability density), Normalization of wave function, Expectation value, Eigen Values and Eigen functions, Application of Schrodinger equation: Particle inside one-dimensional infinite potential well, Energy Eigen values and normalized Eigen Wave function.
Numerical problems: de Broglie Hypothesis, Heisenberg's Uncertainty Principle, One dimensional potential well.
Pre-requisite: Wave-Particle dualism
Self-learning: de Broglie Hypothesis

Module-2 **08 Hours**

Dielectric Properties of Solids and Superconductors:
Dielectric Properties: Polar and non-polar dielectrics, Dielectric constant, Relation between polarization and dielectric constant (Derivation), Types of Polarization, internal fields in solid (Derivation), Clausius- Mossotti equation (Derivation), solid, liquid and gaseous dielectrics. Application of dielectrics: Transformers, Capacitors, and Electrical Insulation.
Superconductors: Introduction to Superconductors, Temperature dependence of resistivity, Meissner's Effect, Silsbee Effect, Types of Super Conductors, Temperature dependence of Critical field, BCS theory (Qualitative), High-Temperature superconductivity, Applications: SQUID and MAGLEV.
Numerical problems: Dielectric constant, Polarization, Clausius - Mossotti equation, Critical field.
Pre-requisites: Classification of materials, conductors, semiconductors, Insulators.
Self-learning: Determination of dielectric constant

Module-3 **08 Hours**

Photonics:
Lasers: Interaction of radiation with matter, Expression for energy density equation (Einstein's coefficients), Requisites of a Laser system, Conditions for Laser action (Population inversion). Principle, Construction and working of Semiconductor LASER, Applications of Lasers: Defense (Laser range finder) and Laser Printing.
Optical Fibers: Principle of optical fibers, Structure of OF, Propagation mechanism, angle of acceptance and acceptance cone, Numerical aperture (Derivation), Fractional index change, Modes of propagation, Number of modes and V-parameter, Types of optical fibers. Attenuation and expression for attenuation coefficient (Derivation), Applications: Discussion of theblock diagram of point-to-point communication, Intensity-based fiber optic displacement sensor, Merits and demerits.
Numerical problems: Power of LASER, Population inversion, Numerical aperture, Attenuation.
Pre-requisite: Properties of light
Self-learning: LASER barcode reader, LASER Cooling.

Module-4 **08 Hours**

Semiconductor and Devices:
Semiconductor: Fermi energy and Fermi level, Fermi level in intrinsic semiconductors (Derivation), Expression for concentration of electrons in conduction band & holes concentration in valance band (only mention the expression), Law of mass action, Electrical conductivity of a semiconductor (Derivation), Hall effect, Expression for Hall coefficient (Derivation) and its application.
Devices: Photodiode and Power responsivity, Construction and working of Semiconducting Laser, Four probe method to determine resistivity, Phototransistor.
Numerical problems: Fermi energy, Conductivity of semiconductors, Hall coefficient

Pre-requisite: Basics of Semiconductors
Self-learning: Band theory of solids, Applications of photodiode.

Module-5	**08 Hours**
Maxwell's Equations and EM waves: **Maxwell's Equations:** Fundamentals of vector calculus. Divergence and curl of electric field and magnetic field (static), Gauss' divergence theorem and Stokes' theorem. Description of laws of electrostatics, magnetism and Faraday's laws of EMI. Current density & equation of Continuity; displacement current (Derivation) Maxwell's equations in vacuum. **EM Waves:** The wave equation in differential form in free space (Derivation of the equation using Maxwell'sequations), Plane electromagnetic waves in vacuum, and their transverse nature. **Numerical problems:** Divergence, Curl, laws of electricity and magnetism. **Pre-requisite:** Electricity & Magnetism **Self-learning:** Fundamentals of vector calculus	

Laboratory Component:
Any Ten Experiments have to be completed from the list of experiments
Note: The experiments have to be classified into

a) Exercise
b) Demonstration
c) Structured Inquiry
d) Open Ended

Based on convenience classify the following experiments into the above categories.
Select at least onesimulation/spreadsheet activity.

List of Experiments:

1. Wavelength of Hg source using grating
2. Numerical Aperture using optical fiber
3. Four Probe Method
4. Charging and Discharging of a Capacitor
5. Transistor Characteristics
6. Photo-Diode Characteristics
7. Series and Parallel LCR Circuits
8. Magnetic Field at any point along the axis of a circular coil
9. Plank's Constant using LEDs.
10. Fermi Energy
11. Black Box
12. Energy Gap of the given Semiconductor

Course outcome:
At the end of the course the student will be able to:

CO1	Describe the fundamental principles of Quantum Mechanics and applications.
CO2	Elucidate the concepts of dielectrics, superconductors and applications.
CO3	Describe the principles of LASERS and Optical fibers and their relevant applications.
CO4	Summarize the properties of semiconductors and the working principles of semiconductor devices, Discuss the fundamentals of vector calculus and their applications in Maxwell's Equations and EM Waves
CO5	Practice working in groups to conduct experiments in Physics and perform precise and honest measurements.

Assessment Details

CIE for the Theory component: 30 Marks

	Components	Number	Weightage	Max. Marks
1	Tests (A)	3	60%	18
2	Alternate Assessment Tools (AAT) (B)	3	40%	12
	Total Marks for theory component A+B			**30**

CIE for the LAB component: 20 Marks

On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.

The laboratory test (duration 02/03 hours) at the end of the 14^{th} /15^{th} week of the semester / after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 20 marks.

Final CIE Marks (Maximum) for IC Courses = 30 + 20 = 50

SEE for IC Theory for 3 hours duration

The question paper will have ten questions. Each question is set for 20 marks.

There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)

The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IC, the total marks of all questions should not be more than the 30 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. A Textbook of Engineering Physics- M.N. Avadhanulu and P.G. Kshirsagar, 10th revised Ed, S. Chand. & Company Ltd, New Delhi.
2. An Introduction to Lasers theory and applications by M.N.Avadhanulu and P.S.Hemne revised Edition 2012. S. Chand and Company Ltd -New Delhi.
3. Engineering Physics-Gaur and Gupta-Dhanpat Rai Publications-2017.
4. Concepts of Modern Physics-Arthur Beiser: 6th Ed;Tata McGraw Hill Edu Pvt Ltd- New Delhi 2006.
5. Fundamentals of Fibre Optics in Telecommunication & Sensor Systems, B.P. Pal, New Age International Publishers.
6. Introduction to Electrodynamics, David Griffith, 4th Edition, Cambridge University Press 2017.
7. Lasers and Non-Linear Optics – B.B. Laud, 3rd Ed, New Age International Publishers 2011.
8. LASERS Principles, Types and Applications by K.R. Nambiar-New Age International Publishers.
9. Solid State Physics-S O Pillai, 8th Ed- New Age International Publishers-2018.

Semester: I/II
(COMMON TO ECE & EEE)

Course Title: Chemistry for Electrical and Electronics Engineering stream

Course Code:	22CHEE12/22	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:2:2:0	Exam Hours	03+02
Total Hours of Pedagogy	40 hours Theory + 10to12 Lab slots	Credits	04

MODULE 1:	08 Hours
Chemistry of Electronic Materials & E-waste Management **Conductors and Insulators:** Introduction, principle with examples. **Semiconductors:** Introduction, production of electronic grade silicon-Czochralski process (CZ) and Float Zone (FZ) methods. **Polymers:** Introduction, Molecular weight - Number average, Weight average and numerical problems. Conducting polymers – synthesis and conducting mechanism of polyacetylene. **E-waste Management:** Introduction, sources, types, effects of e-waste on environment and human health, methods of disposal, advantages of recycling. Extraction of copper and gold from e-waste. **Self-learning:** Preparation, properties and applications of Graphene oxide.	
MODULE 2:	**08 Hours**
Energy Conversion and Storage **Batteries:** Introduction, classification of batteries. Components, construction, working and applications of modern batteries; Na-ion battery, Li-ion battery and flow battery (Vanadium redox flow battery). **Fuel Cells:** Introduction, construction, working and applications of methanol–oxygen and polymer electrolyte membrane (PEM) fuel cell. **Solar Energy:** Introduction, importance of solar PV cell, construction and working of solar PV cell, advantages and disadvantages. **Self-learning:** Electrodes for electrostatic double layer capacitors, pseudo capacitors, and hybrid capacitor.	
MODULE 3:	**08 Hours**
Corrosion Science and Metal finishing **Corrosion Chemistry:** Introduction, electrochemical theory of corrosion, types of corrosion-differential metal and differential aeration. Corrosion control - galvanization, anodization and sacrificial anode method. Corrosion Penetration Rate (CPR) - Introduction and numerical problem. **PCB:** Electroless plating – Introduction, Electroless plating of copper in the manufacture of double-sided PCB. Electrolating, Introduction, Electroplating of chromium. Distinction between electroplating and electro less plating process. **Self-learning:** Technological importance of metal finishing and Electroless plating of nickel. Recycling of PCB and battery components.	
MODULE 4:	**08 Hours**
Nanomaterials and Display Systems **Nanomaterials:** Introduction, size dependent properties of nanomaterials (Surface area, Catalytic, Conducting), preparation of nanomaterials by sol-gel and co-precipitation method with example. Introduction, properties and applications - Nanofibers, Nanophotonics, Nanosensors. **Display Systems:** Liquid crystals (LC's) - Introduction, classification, properties and application in Liquid Crystal Displays (LCD's). Properties and application of Organic Light Emitting Diodes (OLED's) and Quantum Light emitting diodes (QLED's). **Perovskite Materials:** Introduction, properties and applications in optoelectronic devices. **Self-learning:** Properties & electrochemical applications of carbon nanotubes and graphene.	
MODULE 5:	**08 Hours**
Electrode System: Introduction, types of electrodes. Reference electrode - Introduction, calomel electrode – construction, working and applications of calomel electrode. Ion selective electrode – definition, construction, working and applications of glass electrode. Determination of pH using glass electrode. Concentration cell – Definition, construction and Numerical problems.	

Sensors: Introduction, working principle and applications of Conductometric sensors, Electrochemical sensors, Thermometric sensors, and Optical sensors.
Analytical Techniques: Introduction, principle and instrumentation of Colorimetric sensors; its application in the estimation of copper, Potentiometric sensors; its application in the estimation of iron, Conductometric sensors; its application in the estimation of weak acid.
Self-learning: IR and UV- Visible spectroscopy.

PRACTICAL MODULE

[illegible]

A1. Synthesis of polyurethane
A2. Determination of strength of an acid in Pb-acid battery
A3. Synthesis of iron oxide nanoparticles
A4. Electroplating of copper on metallic objects

B – Exercise (compulsorily any 4 to be conducted):
B1.Conductometric estimation of acid mixture
B2. Potentiometric estimation of FAS using $K_2Cr_2O_7$
B3. Determination of pKa of vinegar using pH sensor (Glass electrode)
B4. Determination of rate of corrosion of mild steel by weight loss method
B5. Estimation of total hardness of water by EDTA method

C – Structured Enquiry (compulsorily any 4 to be conducted):
C1. Estimation of Copper present in electroplating effluent by optical sensor (colorimetry)
C2. Determination of Viscosity coefficient of lubricant (Ostwald's viscometer)
C3. Estimation of iron in TMT bar by diphenyl amine/external indicator method
C4. Estimation of Sodium present in soil/effluent sample using flame photometry
C5. Determination of Chemical Oxygen Demand (COD) of industrial waste water sample

D – Open Ended Experiments (any two):
D1. Estimation of metal in e-waste by optical sensors
D2. Electroless plating of Nickle on Copper
D3. Determination of glucose by electrochemical sensors
D4. Synthesis of polyaniline and its conductivity measurement

Corse outcomes:
At the end of the course the student will be able to:

CO1	Apply electronic materials for engineering applications and the methods of e-waste management
CO2	Demonstrate energy conversion and storage in batteries, fuel cells and solar cells.
CO3	Implement the knowledge of corrosion chemistry for corrosion control and electroplating & electro less plating process in the manufacturing of PCB's for engineering applications.
CO4	Apply the basic concepts of chemistry in preparation of nanomaterials and use of liquid crystals in display systems.
CO5	Solve for the problems in chemistry pertinent in engineering applications using sensors in analytical techniques.

Assessment Details

CIE for the Theory component: 30 Marks

	Components	Number	Weightage	Max. Marks
1	Tests (A)	3	60%	18
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	Total Marks for theory component A+B			**30**

CIE for the LAB component: 20 Marks

On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.

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The laboratory test (duration 02/03 hours) at the end of the 14th /15th week of the semester / after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.
Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 20 marks.

Final CIE Marks (Maximum) for IC Courses = 30 + 20 = 50
SEE for IC Theory for 3 hours duration

The question paper will have ten questions. Each question is set for 20 marks.
There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)
The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IC, the total marks of all questions should not be more than the 30 marks.
SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Wiley Engineering Chemistry, Wiley India Pvt. Ltd. New Delhi, 2013- 2nd Edition.
2. Engineering Chemistry, Satyaprakash & Manisha Agrawal, Khanna Book Publishing, Delhi
3. A Text Book of Engg. Chemistry, Shashi Chawla, Dhanpat Rai & Co. (P) Ltd.
4. Essentials of Physical Chemistry, Bahl & Tuli, S.Chand Publishing
5. Applied Chemistry, Sunita Rattan, Kataria 5. Engineering Chemistry, Baskar, Wiley
6. Engineering Chemistry – I, D. Grour Krishana, Vikas Publishing
7. A Text book of Engineering Chemistry, SS Dara & Dr. SS Umare, S Chand & Company Ltd., 12thEdition, 2011.
8. A Text Book of Engineering Chemistry, R.V. Gadag and Nityananda Shetty, I. K. International Publishing house. 2nd Edition, 2016.
9. Text Book of Polymer Science, F.W. Billmeyer, John Wiley & Sons, 4th Edition, 1999.
10. Nanotechnology A Chemical Approach to Nanomaterials, G.A. Ozin& A.C. Arsenault, RSC Publishing, 2005.
11. Corrosion Engineering, M. G. Fontana, N. D. Greene, McGraw Hill Publications, New York, 3rd Edition, 1996.
12. Linden's Handbook of Batteries, Kirby W. Beard, Fifth Edition, McGraw Hill, 2019.
13. OLED Display Fundamentals and Applications, Takatoshi Tsujimura, Wiley–Blackwell , 2012
14. Supercapacitors: Materials, Systems, and Applications, Max Lu, Francois Beguin, Elzbieta Frackowiak, Wiley-VCH; 1st edition, 2013.
15. “Handbook on Electroplating with Manufacture of Electrochemicals”, ASIA PACIFIC BUSINESS PRESS Inc., 2017. Dr. H. Panda,
16. Expanding the Vision of Sensor Materials. National Research Council 1995, Washington, DC: The National Academies Press. doi: 10.17226/4782.
17. Engineering Chemistry, Edited by Dr. Mahesh B and Dr. Roopashree B, Sunstar Publisher, Bengaluru, ISBN 978-93-85155-70-3, 2022
18. High Performance Metallic Materials for Cost Sensitive Applications, F. H. Froes, et al. John Wiley & Sons, 2010
19. Instrumental Methods of Analysis, Dr.K.R.Mahadik and Dr.L. Sathiyanarayanan, NiraliPrakashan, 2020
20. Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, Stanley R. Crouch Seventh Edition, Cengage Learning, 2020
21. Polymer Science, V R Gowariker, N V Viswanathan, Jayadev, Sreedhar, Newage Int. Publishers, 4th Edition, 2021
22. Engineering Chemistry, P C Jain & Monica Jain, Dhanpat Rai Publication, 2015-16th Edition.
23. Nanostructured materials and nanotechnology, Hari Singh, Nalwa, academic press, 1st Edition, 2002.
24. Nanotechnology Principles and Practices, Sulabha K Kulkarni, Capital Publishing Company, 3rd Edition 2014
25. Principles of nanotechnology, Phanikumar, Scitech publications, 2nd Edition, 2010.
26. Chemistry for Engineering Students, B. S. Jai Prakash, R. Venugopal, Sivakumaraiah & Pushpa Iyengar., Subash Publications, 5th Edition, 2014
27. “Engineering Chemistry”, O. G. Palanna, Tata McGraw Hill Education Pvt. Ltd. New Delhi, Fourth Reprint, 2015.
28. Chemistry of Engineering materials, Malini S, K S Anantha Raju, CBS publishers Pvt Ltd.,
29. Laboratory Manual Engg. Chemistry, Anupma Rajput, Dhanpat Rai & Co.

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Semester: I / II

Course Title: Elements of Electrical Engineering

Course Code:	**22EEE13/23**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:2:0:0	Exam Hours	03
Total Hours of Pedagogy	40 hours Theory	Credits	03

Pre-requisites: Students should have basic knowledge of
- Calculus, trigonometry, complex numbers
- Electromagnetism
- Current, voltage, power, power factor
- Series & parallel circuits

Module-1	**08 Hours**
DC circuits: Ohm's law and Kirchhoff's laws, analysis of series, parallel and series-parallel circuits. Power and energy. **Electromagnetism:** Faraday's Laws of Electromagnetic Induction, Lenz's Law, Flemings rules, statically and dynamically induced EMF; concepts of self and mutual inductance. Coefficient of Coupling. Energy stored in magnetic field. Simple Numerical.	
Module-2	**08 Hours**
Single-phase AC circuits: Generation of sinusoidal voltage, frequency of generated voltage, average value, RMS value, form factor and peak factor of sinusoidal voltage and currents. Phasor representation of alternating quantities. Analysis of R, L, C, R-L, R-C and R-L-C circuits with phasor diagrams, Real power, reactive power, apparent power, and Power factor. Series, Parallel and Series-Parallel circuits. Simple Numerical.	
Module-3	**08 Hours**
Three-phase AC circuits: Necessity and advantage of 3-phase system. Generation of 3-phase power. Definition of phase sequence. Balanced supply and balanced load. Relationship between line and phase values of balanced star and delta connections. Measurement of three phase power using Trivector meter. Simple Numerical.	
Module-4	**08 Hours**
Measuring instruments: construction and working principle of whetstone's bridge, Kelvin's double bridge, Megger, Maxwel's bridge for inductance, Schering's bridge for capacitance, concepts of current transformer and potential transformer. (Only balance equations and Excluding Vector diagram approach). **Domestic Wiring:** Requirements, Types of wiring: casing, capping. Two way and three-way control of load.	
Module-5	**08 Hours**
Electrical Energy Consumption: Power rating of household appliances including air conditioners, PCs, laptops, printers, etc. Definition of "unit" used for consumption of electrical energy, two-part electricity tariff, calculation of electrical energy consumption for domestic loads. **Equipment Safety measures**: Working principle of Fuse and Miniature Circuit Breaker (MCB), merits and demerits. **Personal safety measures:** Electric shock, Earthing and its types, safety precautions to avoid shock, and Residual Current Circuit Breaker (RCCB) and Earth Leakage Circuit Breaker (ELCB).	

Outcomes:
At the end of the course the student will be able to:

CO1	**Solve** the problems related to DC circuits and Electromagnetism.
CO2	**Analyze** single phase AC circuits.
CO3	**Analyze** three phase AC circuits.
CO4	**Describe** the procedure to measure the resistance, inductance and capacitance using bridges.
CO5	**Explain** the concepts of domestic wiring, electricity billing, circuit protective devices and personal safety measures.

Assessment Details

CIE:

	Components	Number	Weight age	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks will be proportionally reduced to 50.
The question paper will have 10 full questions carrying 20 marks each.
There will be 2 full questions (with maximum of four sub questions) from each module.
The students will have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)
Text Books:
1. Basic Electrical Engineering by D C Kulshreshtha, Tata McGraw Hill, First Edition 2019.
2. Principles of Power System by V K Mehata, Rohit Mehta, S. Chand Publications, 3rd edition, 2005.

Reference Books
1. Fundamentals of Electrical Engineering and Electronics by B. L. Theraja, S. Chand & Company Ltd, Reprint Edition 2013
2. Electrical Technology by E. Hughes, International Students, Pearson, 9th Edition, 2005
3. Basic Electrical Engineering by D. P. Kothari and I. J. Nagrath, Tata McGraw Hill, 2nd edition, 2017

Semester: I/II

Course Name: Basic Electronics

Course Code	**22BEE13/23**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Pre-requisites: Basics of Semiconductor Physics and Mathematics, Logical reasoning skills.

Module – 1 **08 Hours**

Semiconductor Diodes: Introduction, PN Junction diode, Characteristics and Parameters, Diode Approximations, DC Load Line analysis (Text 1: 2.1,2.2,2.3,2.4)
Diode Applications: Introduction, Half Wave Rectification, Full Wave Rectification, Full Wave Rectifier Power Supply: Capacitor Filter Circuit, RC □ Filter (includes numerical) **(Text 1: 3.1,3.2,3.4,3.5)**
Zener Diodes: Junction Breakdown, Circuit Symbol and Package, Characteristics and Parameters, Equivalent Circuit, Zener Diode Voltage Regulator. (Text1:2.9, 3.7)

Module - 2 **08 Hours**

Bipolar Junction Transistors: Introduction, BJT Voltages & Currents, BJT Amplification, Common Base Characteristics, Common Emitter Characteristics, Common Collector Characteristics, BJT Biasing: Introduction, DC Load line and Bias point (Text 1: 4.2, 4.3, 4.5,4.6, 5.1)
Field Effect Transistor: Junction Field Effect Transistor, JFET Characteristics, MOSFETs: Enhancement MOSFETs, Depletion Enhancement MOSFETs **(Text 1: □.1,□.2,□.5)**

Module – 3 **08 Hours**

Operational Amplifiers: Introduction, The Operational Amplifier, Block Diagram Representation of Typical Op-Amp, Schematic Symbol, Op-Amp parameters - Gain, input resistance, Output resistance, CMRR, Slew rate, Bandwidth, input offset voltage, Input bias Current and Input offset Current, The Ideal Op-Amp , Equivalent Circuit of Op-Amp, Open Loop Op-Amp configurations, Differential Amplifier, Inverting & Non Inverting Amplifier
Op-Amp Applications: Inverting Configuration, Non-Inverting Configuration, Differential Configuration, Voltage Follower, Integrator, Differentiator **(Text 2: 1.1, 1.2, 1.3, 1.5, 2.2, 2.3, 2.4, 2.6, 6.5.1, 6.5.2, 6.5.3, 6.12, 6.13).**

Module – 4 **08 Hours**

Boolean Algebra and Logic Circuits: Binary numbers, Number Base Conversion, octal & Hexa Decimal Numbers, Complements, Basic definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Other Logic Operations, Digital Logic Gates **(Text 3: 1.2, 1.3, 1.4, 1.5,2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7)**
Combinational logic: Introduction, Design procedure, Adders- Half adder, Full adder **(Text 3:4.1, 4.2, 4.3)**

Module – 5 **08 Hours**

Embedded Systems: Definition of Embedded systems, Elements of an Embedded System, Core of the Embedded System, Classification of Embedded Systems, Embedded systems vs general computing systems, Microprocessor vs Microcontroller, Major application areas of Embedded Systems.
Communications: Introduction to communication, Communication System, Modulation **(Text book 5: 1.1, 1.2, 1.3)**

Course Outcomes:
Upon completion of this course, student will be able to:
1. Develop the basic knowledge on construction, operation and characteristics of semiconductor devices
2. Apply the acquired knowledge to construct small scale circuit consisting of semiconductor devices
3. Develop competence knowledge to construct fundamental digital circuits by make use of digital logic associated with basic gates and their functions
4. Interpret the characteristics and technological advances of embedded systems associated with Microprocessors and Microcontroller applications.
5. Construct the conceptual blocks for basic communication system.

Assessment Details

CIE:

	Components	Number	Weight age	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks will be proportionally reduced to 50.
The question paper will have 10 full questions carrying 20 marks each.
There will be 2 full questions (with maximum of four sub questions) from each module.
The students will have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Electronic Devices and Circuits	David A Bell	Oxford	5th Ed.2016
2	Op-amps and Linear Integrated Circuits	Ramakanth A Gayakwad	Pearson Education	4th Edition
3	Digital Logic and Computer Design	M. Morris Mano	PHI Learning	2008
4	Electronic Instrumentation and Measurements	David A. Bell	Oxford University Press	3rd Ed.2013
5	Electronic Communication Systems	George Kennedy	TMH	4th Edition

Semester: II

Course Title: Mathematics for EEE & ECE Stream-II

Course Code:	**22MATE21**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:2:2:0	Exam Hours	03+02
Total Hours of Pedagogy	40 hours Theory + 10-12 Lab Slots	Credits	04

PRE REQUISITES:

Dot and Cross product of vectors, differentiation and Integration
Definition of Differential Equations, method of solving first order differential equations.
Concept of partial differentiation. Formation of differential equation.
Solving quadratic, cubic equations
Solving first order and first degree differential equation analytically.

Module-1 Vector Calculus — **8 hours**

Vector Differentiation: Scalar and vector fields. Gradient, directional derivative, curl and divergence - physical interpretation, solenoidal and irrotational vector fields. Problems.
Vector Integration: Line integrals, Surface integrals. Applications to work done by a force and flux. Statement of Green's theorem and Stoke's theorem. Problems.

Self-Study: Volume integral and Gauss divergence theorem.
Applications: Conservation of laws, Electrostatics, Analysis of stream lines and electric potentials.
(RBT Levels: L1, L2 and L3)

Module-2 Ordinary Differential Equations of higher order — **8 hours**

Higher-order linear ODE's with constant coefficients - Inverse differential operator, method of variation of parameters, Cauchy's and Legendre homogeneous differential equations. Problems.

Self-Study: Formulation and solution of oscillations of a spring. Finding the solution by the method of undetermined coefficients.
Applications: LCR Circuits,

Module-3 Laplace Transform — **8 hours**

Existence and Uniqueness of Laplace transform (LT), transform of elementary functions, region of convergence, Properties–Linearity, Scaling, t-shift property, s-domain shift, differentiation in the s- domain, division by t, differentiation and integration in the time domain, LT of special functions- periodic functions (square wave, saw-tooth wave, triangular wave, full & half wave rectifier), Heaviside Unit step function, Unit impulse function.
Inverse Laplace Transforms:
Definition, properties, evaluation using different methods, convolution theorem (without proof), problems, and Applications to solve ordinary differential equations.
Self-Study: Verification of convolution theorem.
Applications: Signals and systems, Control systems, LR, CR & LCR circuits.
(RBT Levels: L1, L2 and L3)

Module-4 Numerical methods -1 — **8 hours**

Solution of algebraic and transcendental equations - Regula-Falsi and Newton-Raphson methods (only formulae). Problems.
Finite differences, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference formula and Lagrange's interpolation formula (All formulae without proof). Problems.
Numerical integration: Trapezoidal, Simpson's $(1/3)^{rd}$ and $(3/8)^{th}$ rules (without proof). Problems.

Self-Study: Ramanujan's method, Bisection method, Lagrange's inverse Interpolation, Weddle's rule. **Applications:** Estimating the approximate roots, extremum values, Area, volume, surface area.
(RBT Levels: L1, L2 and L3)

Module-5 Numerical methods -2 — **8 hours**

Numerical Solution of Ordinary Differential Equations (ODE's): Numerical solution of ordinary differential equations of first order and first degree - Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor-corrector formula (No derivations of formulae). Problems.

Self-Study: Adam-Bashforth method.
Applications: Estimating the approximate solutions of ODE for electric circuits.
(RBT Levels: L1, L2 and L3).

List of Laboratory experiments (2 hours/week per batch/ batch strength 15)
10 lab sessions + 1 repetition class + 1 Lab Assessment

1	Finding gradient, divergent, curl and their geometrical interpretation
2	Solution of second order differential equations
3	Find the Laplace Transform of some standard functions
4	Find the Inverse Laplace Transform of some standard functions
5	Solution of algebraic and transcendental equation by Ramanujan's, Regula-Falsi and Newton-Raphson method
6	Interpolation/Extrapolation using Newton's forward and backward difference formula
7	Computation of area under the curve using Trapezoidal, Simpson's $(1/3)^{rd}$ and $(3/8)^{th}$ rule
8	Develop a program to solve ODE of first order and first degree by Taylor's series and Modified Euler's method
9	Develop a program to solve ODE of first order and first degree by R-K 4^{th} order method
10	Develop a program to solve ODE of first order and first degree by Milne's predictor-corrector method

Suggested software's: Mathematica/MatLab/Python/Scilab

COURSE OUTCOMES:

CO1	Apply concept of vector calculus to solenoidal, irrotational vectors, Orthogonal curvilinear coordinates.
CO2	Demonstrate various physical models through higher order differential equations and solve such linear ordinary differential equations.
CO3	Solve differential /integral equation arising in network analysis, control systems and other fields of engineering using Laplace Transform and inverse Laplace Transform.
CO4	Apply the knowledge of numerical methods in the modeling of various physical and engineering phenomena.
CO5	Solve first order ODE arising in flow data design problems using appropriate single and multi-step numerical methods.

Assessment Details

CIE for the Theory component: 30 Marks

	Components	Number	Weightage	Max. Marks
1	Tests (A)	3	60%	18
2	Alternate Assessment Tools (AAT) (B)	3	40%	12
	Total Marks for theory component A+B			**30**

CIE for the LAB component: 20 Marks

On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.

The laboratory test (duration 02/03 hours) at the end of the 14^{th} /15^{th} week of the semester / after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 20 marks.

Final CIE Marks (Maximum) for IC Courses = 30 + 20 = 50
SEE for IC Theory for 3 hours duration

The question paper will have ten questions. Each question is set for 20 marks.

There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)

The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IC, the total marks of all questions should not be more than the 30 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year) Text Books

1. B. S. Grewal: “Higher Engineering Mathematics”, Khanna publishers, 44th Ed., 2021.
2. E. Kreyszig: “Advanced Engineering Mathematics”, John Wiley & Sons, 10th Ed., 2018.

Reference Books

1. V. Ramana: “Higher Engineering Mathematics” McGraw-Hill Education, 11th Ed., 2017
2. Srimanta Pal & Subodh C. Bhunia: “Engineering Mathematics” Oxford University Press, 3rd Ed., 2016.
3. N.P Bali and Manish Goyal: “A textbook of Engineering Mathematics” Laxmi Publications, 10th Ed., 2022.
4. C. Ray Wylie, Louis C. Barrett: “Advanced Engineering Mathematics” McGraw – Hill Book Co., Newyork, 6th Ed., 2017.
5. Gupta C.B, Sing S.R and Mukesh Kumar: “Engineering Mathematic for Semester I and II”, Mc-Graw Hill Education (India) Pvt. Ltd 2015.
6. H. K. Dass and Er. Rajnish Verma: “Higher Engineering Mathematics” S. Chand Publication, 3rd Ed., 2014.
7. James Stewart: “Calculus” Cengage Publications, 7th Ed., 2019.
8. David C Lay: “Linear Algebra and its Applications”, Pearson Publishers, 4th Ed., 2018.
9. Gareth Williams: “Linear Algebra with applications”, Jones Bartlett Publishers Inc., 6th Ed., 2017.

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MECHANICAL ENGINEERING STREAM

1st / 2nd Semester Scheme and Syllabus
(Effective from the academic year 2022-23)

Scheme of Teaching andExaminations-2022
Outcome-Based Education (OBE) and Choice Based Credit System (CBCS) (Effective from the academic year 2022-23)

I Semester (Mechanical Engineering Stream) (Physic Group)

SN	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	*ASC(IC)	**22MATM11	Mathematics for MES-I	Maths	2	2	2	0	03	50	50	100	04
2	#ASC(IC)	22PHYM12	Physics for MES	PHY	2	2	2	0	03	50	50	100	04
3	ESC	22EME13	Elements of Mechanical Engineering	Mechanical	2	2	0	0	03	50	50	100	03
4	ESC-I	22ESC14x	Engineering Science Course-I	Respective Engg Dept.	3	0	0	0	03	50	50	100	03
5	ETC-I	22ETC15x	Emerging Technology Course-I	Any Dept.	3	0	0	0	03	50	50	100	03
	OR												
	PLC-I	22PLC15x	Programming Language Course-I		2	0	2	0	03				
6	AEC	22ENG16	Communicative English	Humanities	1	0	0	0	01	50	50	100	01
7	HSMC	22KSK17/ 22KBK17	Samskrutika Kannada/ Balake Kannada	Humanities	1	0	0	0	01	50	50	100	01
		OR											
		22ICO17	Indian Constitution										
8	AEC/SDC	22IDT18	Innovation and Design Thinking	Any Dept.	1	0	0	0	01	50	50	100	01
		OR			OR								
		22SFH18	Scientific Foundations of Health		1	0	0	0	01				
				TOTAL						400	400	800	20

SDA-Skill Development Activities, **TD/PSB**- Teaching Department / Paper Setting Board, **ASC**-Applied Science Course, **ESC**- Engineering Science Courses, **ETC**- Emerging Technology Course, **AEC**- Ability Enhancement Course, HSMS-Humanity and Social Science and management Course, SDC- Skill Development Course, **CIE** –Continuous Internal Evaluation, **SEE**- Semester End Examination, **IC** – Integrated Course (Theory Course Integrated with Practical Course)

Credit Definition:
1-hour Lecture (L) per week=**1Credit**
2-hoursTutorial(T) per week=**1Credit**
2-hours Practical / Drawing (P) per week=**1Credit**
2-hous Skill Development Actives (SDA) per week = **1 Credit**

04-Credits courses are to be designed for 50 hours of Teaching-Learning Session 04-Credits (IC) are to be designed for 40 hours' theory and 12-14 hours of practical sessions
03-Credits courses are to be designed for 40 hours of Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 12-15 hours of Teaching-Learning sessions

Student's Induction Program: Motivating (Inspiring) Activities under the Induction program – The main aim of the induction program is to provide newly admitted students a broad understanding of society, relationships, and values. Along with the knowledge and skill of his/her study, students' character needs to be nurtured as an essential quality by which he/she would understand and fulfill the responsibility as an engineer. The following activities are to be covered in 21 days. Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to Local areas, Familiarization with Department/Branch and Innovation, etc. For details, refer the ANNEXUREI of Induction Programs notification of the University published at the beginning of the 1st semester.

AICTE Activity Points to be earned by students admitted to BE/ B.Tech., / B. Plan day college program (For more details refer to Chapter 6, AICTE Activity Point Program, Model Internship Guidelines): Over and above the academic grades, every regular student admitted to the 4 years Degree program and every student entering 4 years Degree programs through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Program. Students transferred from other Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, any time during the semester weekends, and holidays, as per the liking and convenience of the student from the year of entry to the program. However, the minimum hour's requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, an Eighth Semester Grade Card shall be issued only after earning the required activity points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

-22MATC11** Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory question papers * The mathematics subject should be taught by a single faculty member per division, with no sharing of the course(subject)module-wise by different faculty members.**
#-22PHYC12 SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination
ESC or ETC of 03 Credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature of the course required practical learning then the syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0).
All 01 Credit- courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

(ESC-I) Engineering Science Courses-I					(ETC-I) Emerging Technology Courses-I				
Code	Title	L	T	P	Code	Title	L	T	P
22ESC141	Introduction to Civil Engineering	3	0	0	22ETC15A	Smart materials and Systems	3	0	0
22ESC142	Introduction to Electrical Engineering	3	0	0	22ETC15B	Green Buildings	3	0	0
22ESC143	Introduction to Electronics Engineering	3	0	0	22ETC15E	Renewable Energy Sources	3	0	0
22ESC144	Introduction to Mechanical Engineering	3	0	0	22ETC15F	Drone technology	3	0	0
22ESC145	Introduction to C Programming	2	0	2	22ETC15G	Introduction to Sustainable Engineering	3	0	0
					22ETC15H	Introduction to Internet of Things(IoT)	3	0	0
					22ETC15I	Waste Management	3	0	0
					22ETC15J	Introduction to Cyber Security	3	0	0
(PLC-I) Programming Language Courses-I									
Code	Title	L	T	P					
22PLC15A	Introduction to Web Programming	2	0	2					
22PLC15B	Introduction to Python Programming	2	0	2					
22PLC15C	Basics of JAVA programming	2	0	2					
22PLC15D	Introduction to C++ Programming	2	0	2					
The course 22ESC145/245, Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT									

- The student has to select one course from the ESC-I group.
- MES stream Students shall opt for any one of the courses from the ESC-I group **except, 22ESC144-Introduction to Mechanical Engineering**
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-I or PLC-I group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

Scheme of Teaching and Examinations-2022
Outcome-Based Education (OBE) and Choice Based Credit System (CBCS) (Effective from the academic year 2022-23)
II Semester (Mechanical Engineering Stream) (for students who attended I semester under Physics Group)

SN	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	*ASC(IC)	** 22MATM21	Mathematics for MES-II	Maths	2	2	2	0	03	50	50	100	04
2	#ASC(IC)	22CHEM22	Chemistry for MES	Chemistry	2	2	2	0	03	50	50	100	04
3	ESC	22CED23	Computer-Aided Engineering Drawing	Civil/ Mech Engg Dept.	2	0	2	0	03	50	50	100	03
4	ESC-II	22ESC24x	Engineering Science Course-II	Respective Engg Dept.	3	0	0	0	03	50	50	100	03
5	PLC-II	22PLC25x	Programming Language Course-II	Any. Dept.	2	0	2	0	03	50	50	100	03
	OR												
	ETC-II	22ETC25x	Emerging Technology Course-II		3	0	0	0	03				
6	AEC	22PWS26	Professional Writing Skills in English	Humanities	1	0	0	0	01	50	50	100	01
7	HSMS	22ICO27	Indian Constitution	Humanities	1	0	0	0	01	50	50	100	01
		OR											
		22KSK27 22KBK27	Samskrutika Kannada/ Balake Kannada										
8	HSMS	22SFH28	Scientific Foundations of Health	Any Dept.	1	0	0	0	01	50	50	100	01
	OR				OR								
	HSMS	22ITD29	Innovation and Design Thinking	Any	1	0	0	0	01	50	50	100	
TOTAL										**400**	**400**	**800**	**20**

SDA-Skill Development Activities, TD/PSB- Teaching Department / Paper Setting Board, ASC-Applied Science Course, ESC- Engineering Science Courses, ETC- Emerging Technology Course, AEC- Ability Enhancement Course, HSMS-Humanity and Social Science and management Course, SDC- Skill Development Course,
CIE -Continuous Internal Evaluation, SEE- Semester End Examination, IC – Integrated Course (Theory Course Integrated with Practical Course)

Credit Definition:	
1-hour Lecture (L) per week=1Credit 2-hoursTutorial(T) per week=1Credit 2-hours Practical / Drawing (P) per week=1Credit 2-hous Skill Development Actives (SDA) per week = 1 Credit	04-Credits courses are to be designed for 50 hours of Teaching-Learning Session 04-Credits (IC) are to be designed for 40 hours' theory and 12-14 hours of practical sessions 03-Credits courses are to be designed for 40 hours of Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 12-15 hours of Teaching-Learning sessions

***-22MAT21** Shall have the 03 hours of theory examination (SEE), however, practical sessions question shall be included in the theory question papers. ** The mathematics subject should be taught by single faculty member per division, with no sharing of the course (subject) module-wise by different faculty members.
#-22CHE22- SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination
ESC or ETC of 03 credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required practical learning syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0).
All 01 Credit- courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

(ESC-II) Engineering Science Courses-II					(ETC-II) Emerging Technology Courses-II				
Code	Title	L	T	P	Code	Title	L	T	P
22ESC241	Introduction to Civil Engineering	3	0	0	22ETC25A	Smart materials and Systems	3	0	0
22ESC242	Introduction to Electrical Engineering	3	0	0	22ETC25B	Green Buildings	3	0	0
22ESC243	Introduction to Electronics Engineering	3	0	0	22ETC25E	Renewable Energy Sources	3	0	0
22ESC244	Introduction to Mechanical Engineering	3	0	0	22ETC25F	Drone technology	3	0	0
22ESC245	Introduction to C Programming	2	0	2	22ETC25G	Introduction to Sustainable Engineering	3	0	0
					22ETC25H	Introduction to Internet of Things(IoT)	3	0	0
					22ETC25I	Waste Management	3	0	0

					22ETC25J	Introduction to Cyber Security	3	0	0
(PLC-II) Programming Language Courses-II									
Code	**Title**	**L**	**T**	**P**					
22PLC25A	Introduction to Web Programming	2	0	2					
22PLC25B	Introduction to Python Programming	2	0	2					
22PLC25C	Basics of JAVA programming	2	0	2					
22PLC25D	Introduction to C++ Programming	2	0	2					
The course 22ESC145/245, Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT									

- The student has to select one course from the ESC-II group.
- Mechanical Engineering stream Students shall opt for any one of the courses from the ESC-II group **except, 22ESC244-Introduction to Mechanical Engineering**
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-II or PLC-II group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

Scheme of Teaching and Examinations-2022
Outcome-Based Education (OBE) and Choice Based Credit System (CBCS) (Effective from the academic year 2022-23)
I Semester (Mechanical Engineering Stream) (Chemistry Group)

SN	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	*ASC(IC)	**22MATM 11	Mathematics for ME Streams-I	Maths	2	2	2	0	03	50	50	100	04
2	#ASC(IC)	22CHEM12	Chemistry for ME Streams	Chemistry	2	2	2	0	03	50	50	100	04
3	ESC	22CED13	Computer Aided Engineering Drawing	Civil/Mech Engg Dept.	2	0	2	0	03	50	50	100	03
4	ESC-I	22ESC14x	Engineering Science Course-I	Respective Dept.	3	0	0	0	03	50	50	100	03
5	ETC-I	22ETC15x	Emerging Technology Course-I	Any Dept.	3	0	0	0	03	50	50	100	03
	OR												
	PLC-I	22PLC15x	Programming Language Course-I		2	0	2	0	03				
6	AEC	22ENG16	Communicative English	Humanities	1	0	0	0	01	50	50	100	01
7	HSMS	22ICO17	Indian Constitution	Humanities	1	0	0	0	01	50	50	100	01
		OR											
		22KSK17/ 22KBK17	Samskrutika Kannada/ Balake Kannada										
8	HSMS	22SFH18	Scientific Foundations of Health	Any Dept.	1	0	0	0	01	50	50	100	01
	OR												
	HSMS	22ITD18	Innovation and Design Thinking	Any Dept.	1	0	0	0	01				
	TOTAL				15	06	10	00	27	400	400	800	20

SDA-Skill Development Activities, TD/PSB- Teaching Department / Paper Setting Board, ASC-Applied Science Course, ESC- Engineering Science Courses, **ETC-** Emerging Technology Course, AEC- Ability Enhancement Course, HSMS-Humanity and Social Science and management Course, **SDC-** Skill Development Course,

CIE -Continuous Internal Evaluation, SEE- Semester End Examination, IC – Integrated Course (Theory Course Integrated with Practical Course)

***22MAT11** Shall have the 03 hours of theory examination (SEE), however, practical sessions question shall be included in the theory question papers. ** The mathematics subject should be taught by single faculty member per division, with no sharing of the course (subject) module-wise by different faculty members.
#-22CHEC12- SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination
ESC or ETC of 03 credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required practical learning syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0).
All 01 Credit- courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

Credit Definition: 1-hour Lecture (L) per week=1Credit 2-hoursTutorial(T) per week=1Credit 2-hours Practical / Drawing (P) per week=1Credit 2-hous Skill Development Actives (SDA) per week = 1 Credit	04-Credits courses are to be designed for 50 hours of Teaching-Learning Session 04-Credits (IC) are to be designed for 40 hours' theory and 12-14 hours of practical sessions 03-Credits courses are to be designed for 40 hours of Teaching-Learning Session 02-Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 12-15 hours of Teaching-Learning sessions

Student's Induction Program: Motivating (Inspiring) Activities under the Induction program – The main aim of the induction program is to provide newly admitted students a broad understanding of society, relationships, and values. Along with the knowledge and skill of his/her study, students' character needs to be nurtured as an essential quality by which he/she would understand and fulfil the responsibility as an engineer. The following activities are to be covered in 21 days. Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to Local areas, Familiarization with Department/Branch and Innovation, etc. For details, refer the ANNEXUREI of Induction Programs notification of the University published at the beginning of the 1st semester.

AICTE Activity Points to be earned by students admitted to BE/ B.Tech., / B. Plan day college program (For more details refer to Chapter 6, AICTE Activity Point Program, Model Internship Guidelines): Over and above the academic grades, every regular student admitted to the 4 years Degree program and every student entering 4 years Degree programs through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Program. Students transferred from other Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, any time during the semester weekends, and holidays, as per the liking and convenience of the student from the year of entry to the program. However, the minimum hour's requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, an Eighth Semester

Grade Card shall be issued only after earning the required activity points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

(ESC-I) Engineering Science Courses-I					**(ETC-I) Emerging Technology Courses-I**				
Code	**Title**	**L**	**T**	**P**	**Code**	**Title**	**L**	**T**	**P**
22ESC141	Introduction to Civil Engineering	3	0	0	22ETC15A	Smart materials and Systems	3	0	0
22ESC142	Introduction to Electrical Engineering	3	0	0	22ETC15B	Green Buildings	3	0	0
22ESC143	Introduction to Electronics Engineering	3	0	0	22ETC15E	Renewable Energy Sources	3	0	0
22ESC144	Introduction to Mechanical Engineering	3	0	0	22ETC15F	Drone technology	3	0	0
22ESC145	Introduction to C Programming	2	0	2	22ETC15G	Introduction to Sustainable Engineering	3	0	0
					22ETC15H	Introduction to Internet of Things(IoT)	3	0	0
					22ETC15I	Waste Management	3	0	0
					22ETC15J	Introduction to Cyber Security	3	0	0
							3	0	0
(PLC-I) Programming Language Courses-I									
Code	**Title**	**L**	**T**	**P**					
22PLC15A	Introduction to Web Programming	2	0	2					
22PLC15B	Introduction to Python Programming	2	0	2					
22PLC15C	Basics of JAVA programming	2	0	2					
22PLC15D	Introduction to C++ Programming	2	0	2					
The course 22ESC145/245, Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT									

- The student has to select one course from the ESC-I group.
- MES stream Students shall opt for any one of the courses from the ESC-I group **except, 22ESC144-Introduction to Mechanical Engineering**
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-I or PLC-I group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

Scheme of Teaching and Examinations-2022
Outcome-Based Education (OBE) and Choice Based Credit System (CBCS) (Effective from the academic year 2022-23)
II Semester (Mechanical Engineering Stream) (For the students who attended I semester under Chemistry Group)

Sl. No	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	*ASC(IC)	**22MATM21	Mathematics for ME Streams-II	Maths	2	2	2	0	03	50	50	100	04
2	#ASC(IC)	22PHYM22	Physics for ME Streams	PHY	2	2	2	0	03	50	50	100	04
3	ESC	22EME23	Elements of Mechanical Engineering	Mechanical	2	2	0	0	03	50	50	100	03
4	ESC-II	22ESC24x	Engineering Science Course-II	Respective Engg Dept.	3	0	0	0	03	50	50	100	03
5	PLC-II	22PLC25x	Programming Language Course-II	Any Dept.	2	0	2	0	03	50	50	100	03
	OR												
	ETC-II	22ETC25x	Emerging Technology Course-II		3	0	0	0	03				
6	AEC	22PWS26	Professional Writing Skills in English	Humanities	1	0	0	0	01	50	50	100	01
7	HSMC	22KSK27 22KBK27	Samskrutika Kannada/ Balake Kannada	Humanities	1	0	0	0	01	50	50	100	01
		OR											
		22ICO27	Indian Constitution										
8	AEC/SDC	22IDT28	Innovation and Design Thinking	Any Dept.	1	0	0	0	01	50	50	100	01
		OR											
		22SFH28	Scientific Foundations of Health		1	0	0	0					
			TOTAL							**400**	**400**	**800**	**20**

SDA-Skill Development Activities, TD/PSB- Teaching Department / Paper Setting Board, ASC-Applied Science Course, ESC- Engineering Science Courses, ETC- Emerging Technology Course, AEC- Ability Enhancement Course, HSMS-Humanity and Social Science and management Course, SDC- Skill Development Course,
CIE –Continuous Internal Evaluation, SEE- Semester End Examination, IC – Integrated Course (Theory Course Integrated with Practical Course)

***-22MATC21** shall have the 03 hours of theory examination (SEE), however, practical sessions question shall be included in the theory question papers. ** **The mathematics subject should be taught by single faculty member per division, with no sharing of the course (subject) module-wise by different faculty members.**
#-22PHYC22 SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination
ESC or ETC of 03 credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required experimental learning then the syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0). However, there is no SEE for the practical component.
All 01 Credit- courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

(ESC-II) Engineering Science Courses-II

Code	Title	L	T	P
22ESC241	Introduction to Civil Engineering	3	0	0
22ESC242	Introduction to Electrical Engineering	3	0	0
22ESC243	Introduction to Electronics Engineering	3	0	0
22ESC244	Introduction to Mechanical Engineering	3	0	0
22ESC245	Introduction to C Programming	2	0	2

(ETC-II) Emerging Technology Courses-II

Code	Title	L	T	P
22ETC25A	Smart materials and Systems	3	0	0
22ETC25B	Green Buildings	3	0	0
22ETC25E	Renewable Energy Sources	3	0	0
22ETC25F	Drone technology	3	0	0
22ETC25G	Introduction to Sustainable Engineering	3	0	0
22ETC25H	Introduction to Internet of Things(IoT)	3	0	0
22ETC25I	Waste Management	3	0	0
22ETC25J	Introduction to Cyber Security	3	0	0

(PLC-II) Programming Language Courses-II

Code	Title	L	T	P
22PLC25A	Introduction to Web Programming	2	0	2
22PLC25B	Introduction to Python Programming	2	0	2
22PLC25C	Basics of JAVA programming	2	0	2
22PLC25D	Introduction to C++ Programming	2	0	2

The course 22ESC145/245, Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT

- The student has to select one course from the ESC-II group.
- Mechanical Engineering stream Students shall opt for any one of the courses from the ESC-II group **except, 22ESC244-Introduction to Mechanical Engineering**
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-II or PLC-II group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

Semester: I

Course Title: Mathematics for Mechanical Stream-I

Course Code:	**22MATM11**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:2:2:0	Exam Hours	03+02
Total Hours of Pedagogy	40 hours Theory + 10-12 Lab Slots	Credits	04

PRE REQUISITES

Matrices and Determinants.
Differentiation basic formulae, differentiation of a function of a function
Differentiation basic formulae, differentiation of a function of a function
Definition of Differential Equations, Formation of Differential equations, order and degree of a differential equations. Basic formulae of Integration.
Basic formulae of Integration and evaluation of Definite Integrals

Module-1 Linear Algebra — **8 hours**

Elementary row transformation of a matrix, Rank of a matrix. Consistency and Solution of system of linear equations - Gauss-Elimination method, Gauss-Jordan method and approximate solution by Gauss-Seidel method. Rayleigh's power method to find the dominant Eigen value and the corresponding Eigenvector. Problems
Self-Study: Diagonalization of a square matrix of order 2, Solution of system of equations by Gauss-Jacobi iterative method, Inverse of a square matrix by Cayley- Hamilton theorem.
Applications: Network Analysis, Balancing equations.
(RBT Levels: L1, L2 and L3).

Module-2 Calculus — **8 hours**

Polar coordinates, Polar curves, angle between the radius vector and tangent, angle between two curves. Pedal equation. Curvature and Radius of curvature – Cartesian and Polar forms (with proof). Problems.
Self-study: Radius of curvature-Parametric form, Center and circle of curvature, evolutes and involutes.
Applications: Applied Mechanics, Strength of Materials, Elasticity.
(RBT Levels: L1, L2 and L3)

Module-3 Series Expansion and Multivariable Calculus — **8 hours**

Taylor's series, Maclaurin's series expansion for one variable (Statement only) – problems.
Partial differentiation, total derivative - differentiation of composite functions. Jacobian and problems. Maxima and minima for a function of two variables. Problems.
Self-study: Euler's theorem and problems. Method of Lagrange's undetermined multipliers with single constraint.
Applications: Computation of stress and strain, Errors and approximations in manufacturing process, Estimating the critical points and extreme values, vector calculus.
(RBT Levels: L1, L2 and L3)

Module-4 Ordinary Differential Equations (ODEs) of first order — **8 hours**

Bernoulli's differential equations. Exact and reducible to exact differential equations -
Integrating factors on $\frac{1}{\ }(— \square —)$ and $\frac{1}{\ }(— \square —)$. Applications of ODE's - Orthogonal Trajectories and L-R circuits. Problems.
Non-linear differential equations: Introduction to general and singular solutions, Solvable for p only, Clairaut's equations. Problems.
Self-Study: Applications of ODE's, Solvable for x and y.
Applications: Rate of Growth or Decay, Conduction of heat.
(RBT Levels: L1, L2 and L3)

Module-5 Integral Calculus — **8 hours**

Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by changing the order of integration. Applications to find Area and Volume by double and triple integral. **Problems.**
Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions (with proof). Problems.

Self-Study: Evaluation of double integrals by changing into Polar co-ordinates, Center of gravity, Duplication formula. Reduction formulae
Applications: Applications to mathematical quantities (Area, Surface area, Volume)
(RBT Levels: L1, L2 and L3)

List of Laboratory experiments (2 hours/week per batch/ batch strength 15)
10 lab sessions + 1 repetition class + 1 Lab Assessment

1	2D plots for Cartesian and polar curves
2	Finding angle between polar curves, curvature and radius of curvature of a given curve
3	Finding partial derivatives, Jacobian and plotting the graph
4	Applications to Maxima and Minima of two variables
5	Solution of first order differential equation and plotting the graphs
6	Evaluation of Double & Triple Integrals (With and Without Limits)
7	Rank of a Matrix
8	Numerical solution of system of linear equations, test for consistency and graphical representation
9	Solution of system of linear equations using Gauss-Seidel iteration
10	Compute eigenvalues and eigenvectors and find the largest and smallest eigenvalue by Rayleigh power method.

Suggested software's: Mathematica/MatLab/Python/Scilab

COURSE OUTCOMES:

CO1	Apply matrix theory for solving for system of linear equations and compute Eigen values and Eigen vectors
CO2	Apply the knowledge of calculus to solve problems related to polar curves
CO3	Learn the notion of partial differentiation to compute rate of change multi variate functions
CO4	Solve the first order linear/non-linear differential equations analytically using standard methods
CO5	Apply the concept of change the order of the Integration and variables to evaluate multiple integrals and their usage in computing the area and the volumes.

Assessment Details

CIE for the Theory component: 30 Marks

	Components	**Number**	**Weightage**	**Max. Marks**
1	Tests (A)	3	60%	18
2	Alternate Assessment Tools(AAT) (B)	3	40%	12
	Total Marks for theory component A+B			**30**

CIE for the LAB component: 20 Marks

On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.

The laboratory test (duration 02/03 hours) at the end of the 14th /15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for20 marks.

Final CIE Marks (Maximum) for IC Courses = 30 + 20 = 50
SEE for IC Theory for 3 hours duration

The question paper will have ten questions. Each question is set for 20 marks.

There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)

The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included.

The maximum of 04/05 questions to be set from the practical component of IC, the total marks of all questions should not be more than the 30 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources: -

Books (Title of the Book / Name of the author / Name of the publisher / Edition and Year)

Text Books:

B.S.Grewal: "Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021
E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.

Reference Books:

V.Ramana: "Higher Engineering Mathematics "McGraw-Hill Education, 11th Ed., 2017
Srimanta Pal & Subodh C. Bhunia: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.

Semester: I/II

Course Title: Physics for Mechanical Engineering Stream

Course Code:	**22PHYM12/22**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:2:2:0	Exam Hours	03+02
Total Hours of Pedagogy	40 hours Theory + 10-12 Lab Slots	Credits	04

Module-1	**8 Hours**
Oscillations and Shock waves: **Oscillations:** Simple Harmonic motion (SHM), differential equation for SHM (Derivation), Sprigs: Stiffness Factor and its Physical Significance, series and parallel combination of springs (Derivation), Types of spring and their applications. Theory of damped oscillations (Derivation), Types of damping (Graphical Approach). Engineering applications of damped oscillations, Theory of forced oscillations (Qualitative), resonance and sharpness of resonance. **Shock waves:** Mach number and Mach Angle, Mach Regimes, definition and characteristics of Shock waves, Construction and working of Reddy shock tube, Applications of Shock Waves. **Numerical problems:** Spring constant, Time period, Series and parallel combination of springs, Mach number **Pre-requisites:** Basics of Oscillations Self-learning: Definition of waves, Types of waves, Difference between light and sound waves	
Module-2	**8 Hours**
Elasticity: Stress-Strain Curve, Stress hardening and softening. Elastic Moduli, Poisson's ratio and its limiting values. Relation between elastic constant (Derivation), Beams, bending moment (Derivation), Y by Cantilever (Derivation) and I section girder and their Engineering Applications, Elastic materials (Qualitative). Failures of engineering materials: ductile fracture, brittle fracture, stress concentration, fatigue and factors affecting fatigue (only qualitative explanation). Numerical problems: Elastic Moduli, Y by cantilever **Pre-requisites:** Elasticity, Stress & Strain **Self-learning:** Hooks law, Plasticity	
Module-3	**8 Hours**
Thermoelectric materials and devices: Thermo emf and thermo current, Seeback effect, Peltier effect, Seeback and Peltier coefficients, figure of merit (Mention Expression), laws of thermoelectricity, Expression for thermo emf in terms of T1 and T2 (Derivation), Thermo couples, thermopile, Construction and Working of Thermoelectric generators (TEG) and Thermoelectric coolers (TEC), low, mid and high-temperature thermoelectric materials, Applications: Exhaust of Automobiles, Refrigerator, Space Program (RTG). **Numerical Problems:** Thermo-emf, Thermo electric power, **Pre-requisites:** Basics of Thermal and Electrical conductivity **Self-learning:** Thermal and electrical properties of materials.	
Module-4	**8 Hours**
Thermodynamics and Cryogenics: **Thermodynamics:** First law of thermodynamics, Determination of J by Joule's method, Second law of thermodynamics, thermodynamic process, Heat engine, Thermal efficiency of heat engines, Carnot's cycle, Carnot's engine and efficiency of Carnot's cycle, Carnot's theorem, Concept of entropy, Change in entropy in reversible and irreversible process, Entropy and disorder: third law of thermodynamics. **Cryogenics:** Production of low temperature, Joule Thomson effect (Qualitative), Porous plug experiment, Lindey's air liquefier, Applications of cryogenics: Aerospace, Tribology and food processing (qualitative). **Numerical problems:** Laws of thermodynamics, Efficiency of heat engine. **Pre-requisites:** Basics of Heat and Thermodynamics **Self-learning:** Definition of heat and Temperature, Conduction of heat.	
Module-5	**8 Hours**
Nano-Material and Instrumentation Techniques: Nanomaterials: Introduction to Nanomaterials and nanocomposites, synthesis of nano-materials, Ball milling and Sol-gel methods, carbon nano tube (Qualitative), Applications of nano-materials. **Instrumentation Techniques:** X – Ray diffraction, Principle, construction and working of X-ray Diffractometer, Crystallite size determination by Scherrer equation, Principle, construction and working of X-ray photoelectron spectroscopy (XPS), Scanning electron microscopy (SEM), Transmission electron microscopy (TEM). **Pre-requisites:** What is nano, Characterization of materials	

Self-learning: X – ray diffraction, Bragg's law, Crystal structure

Laboratory Component:
Any Ten Experiments have to be completed from the list of experiments

Note:
The experiments have to be classified into: Exercise, b) Demonstration, c) Structured Inquiry, d) Open Ended
Based on convenience classify the following experiments into the above categories. Select at least one simulation /spread sheet activity.

List of Experiments:
1. Uniform Bending
2. n by Torsional Pendulum
3. Forced Mechanical Oscillations and Resonance
4. Series & Parallel Resonance
5. Fermi Energy of Conductor
6. Resistivity by Four Probe Method
7. Spring Constant
8. Single Cantilever
9. I by Torsional pendulum
10. Wavelength of Hg source by Diffraction grating.
11. Ultrasonic Interferometer
12. Newton's Rings
13. GNU Step Interactive Simulations
14. Study of motion using spread Sheets
15. Application of Statistic using Spread Sheets

Course outcome (Course Skill Set)
At the end of the course the student will be able to:

CO1	**Elucidate** the concepts in oscillations and shock waves,
CO2	**Elucidate** the properties of elasticity and material failures
CO3	**Discuss** the fundamentals of Thermoelectric materials and their application
CO4	**Summarize** Thermodynamics, the low-temperature phenomena and generation of low temperature, **Explain** the various material characterization techniques
CO5	**Practice** working in groups to conduct experiments in Physics and **perform** precise and honest measurements.

Assessment Details

CIE for the Theory component: 30 Marks

	Components	Number	Weightage	Max. Marks
1	Tests (A)	3	60%	18
2	Alternate Assessment Tools(AAT) (B)	3	40%	12
	Total Marks for theory component A+B			30

CIE for the LAB component: 20 Marks

On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.

The laboratory test (duration 02/03 hours) at the end of the 14th /15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for20 marks.

Final CIE Marks (Maximum) for IC Courses = 30 + 20 = 50

SEE for IC Theory for 3 hours duration

The question paper will have ten questions. Each question is set for 20 marks.

There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)

The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IC, the total marks of all questions should not be more than the 30 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources: Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Vibrations and Waves (MIT introductory Physics Series), A P French, CBS, 2003 Edition
2. Timoshenko, S. and Goodier J.N. “Theory of Elasticity”, 2nd Edition, McGraw Hill Book Co, 2001.
3. Sadhu Singh, “Theory of Elasticity”, Khanna Publishers, 1997
4. Mechanical Properties of Engineered Materials By Wole Soboyejo, CRC Press; 1st edition, 2002
5. Heat & Thermodynamics and Statistical Physics(XVIII-Edition) – Singhal, Agarwal &Satyaprakash – Pragati Prakashan, Meerut, 2006. 4
6. Heat and Thermodynamics (I-Edition) – D.S.Mathur - S. Chand & Company Ltd., New-Delhi, 1991
7. Heat and Thermodynamics,Brijlal& Subramanyam,S. Chand & Company Ltd., New-Delhi.
8. Physics of Cryogenics by Bahman Zohuri, Elsevier, 2018
9. Materials Characterization Techniques-Sam Zhang, Lin Li, Ashok Kumar, CRC Press, First Edition, 2008.
10. Characterization of Materials- Mitra P.K . Prentice Hall India Learning Private Limited.
11. Nanoscience and Nanotechnology: Fundamentals to Frontiers – M.S.Ramachandra Rao & Shubra Singh, Wiley India Pvt Ltd.
12. Nano Composite Materials-Synthesis, Properties and Applications, J. Parameswaranpillai, N.Hameed, T.Kurian,
13. Y. Yu, CRC Press.Shock waves made simple by Chintoo S Kumar, K Takayama and K P J Reddy: Willey India Pvt. Ltd, Delhi,2014

Semester: I/II

Course Title: Chemistry for Mechanical Engineering stream

Course Code:	**22CHEM12/22**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:2:2:0	Exam Hours	03+02
Total Hours of Pedagogy	40 hours Theory + 10 to 12 Lab slots	Credits	04

Module-1: Energy Source, Conversion and Storage **8 hours**

Fuels: Introduction, calorific value, determination of calorific value using bomb calorimeter, numerical problems on GCV and NCV.
Green fuels: Introduction, power alcohol, synthesis and applications of biodiesel.
High energy fuels: Production of hydrogen by electrolysis of water and its advantages.
Energy devices: Introduction, construction, working, and applications of Photovoltaic cells, Li-ion battery and methanol-oxygen fuel cell.
Self-learning: Plastic recycling to fuels and its monomers or other useful products.

Module-2: Corrosion Science and Engineering **8 hours**

Corrosion: Introduction, electrochemical theory of corrosion, types of corrosion-differential metal, differential aeration (waterline and pitting), stress corrosion (caustic embrittlement).
Corrosion control: Metal coating-galvanization, surface conversion coating-anodization and cathodic protection-sacrificial anode method. Corrosion testing by weight loss method. Corrosion penetration rate (CPR)-numerical problems.
Metal finishing: Introduction, technological importance.
Electroplating: Introduction, Electroplating of chromium (hard and decorative).
Electroless plating: Introduction, electroless plating of nickel.
Self-learning: Factors affecting the rate of corrosion, factors influencing the nature and quality of electrodeposit (Current density, concentration of metal ion, pH and temperature).

Module-3: Macromolecules for Engineering Applications **8 hours**

Polymers: Introduction, methods of polymerization (Condensation and Addition), molecular weight; number average and weight average, numerical problems. Synthesis, properties and industrial applications of polyvinylchloride (PVC) and polystyrene.
Fibers: Introduction, synthesis, properties and industrial applications of Kevlar and Polyester.
Plastics: Introduction, synthesis, properties and industrial applications of poly (methyl methacrylate) (PMMA) and Teflon.
Composites: Introduction, properties and industrial applications of carbon-based reinforced composites (graphene / carbon nano-tubes as fillers) and metal matrix polymer composites.
Lubricants: Introduction, classification, properties and applications of lubricants.
Self-learning: Biodegradable polymer: Introduction, synthesis, properties and applications of polylactic acid (PLA).

Module-4: Phase Rule and Analytical Techniques **8 hours**

Phase rule: Introduction, Definition of terms: phase, components, degree of freedom, phase rule equation. Phase diagram: Two component-lead-silver system.
Analytical techniques: Introduction, principle, instrumentation of potentiometric sensors; its application in the estimation of iron, Optical sensors (colorimetry); its application in the estimation of the copper, pH-sensor (Glass electrode); its application in the determination of pH of beverages.
Self-learning: Determination of viscosity of biofuel and its correlation with temperature.

Module-5: Materials for Engineering Applications 8 hours

Alloys: Introduction, classification, composition, properties and applications of Stainless Steel, Solders, Brass and Alnico.
Ceramics: Introduction, classification based on chemical composition, properties and applications of perovskites ($CaTiO_3$).
Nanochemistry: Introduction, size-dependent properties of nanomaterial (surface area, catalytical and thermal), synthesis of nanoparticles by sol-gel, and co-precipitation method. **Nanomaterials:** Introduction, properties and engineering applications of carbon nanotubes and graphene.

Self-learning: Abrasives: Introduction, classification, properties and applications of silicon carbide (carborundum).

PRACTICAL MODULE

A – Demonstration (any two) offline/virtual:
A1. Synthesis of polyurethane
A2. Preparation of urea formaldehyde resin
A3. Synthesis of iron oxide nanoparticles
A4. Determination of acid value of biofuel

B – Exercise (compulsorily any 4 to be conducted):
B1. Conductometric estimation of acid mixture
B2. Potentiometric estimation of FAS using $K_2Cr_2O_7$
B3. Determination of pKa of vinegar using pH sensor (Glass electrode)
B4. Determination of rate of corrosion of mild steel by weight loss method
B5. Estimation of total hardness of water by EDTA method

C – Structured Enquiry (compulsorily any 4 to be conducted):
C1. Estimation of Copper present in electroplating effluent by optical sensor (colorimetry)
C2. Determination of Viscosity coefficient of lubricant (Ostwald's viscometer)
C3. Estimation of iron in TMT bar by diphenyl amine/external indicator method
C4. Estimation of Sodium present in soil/effluent sample using flame photometry
C5. Determination of Chemical Oxygen Demand (COD) of industrial waste water sample

D – Open Ended Experiments (any two):
D1. Estimation of percentage of iron in steel
D2. Electroplating of desired metal on substrate
D3. Synthesis of biodiesel
D4. Synthesis of Aluminium Oxide nano particle

[illegible]

At the end of the course the student will be able to:

CO1	Demonstrate production of alternative energy sources and conversion and storage in batteries, fuel cells and solar cells.
CO2	Implement the knowledge of corrosion chemistry for corrosion control and electroplating & electro less plating process for engineering applications.
CO3	Analyze the properties and applications of macromolecular polymers for engineering applications
CO4	Solve for the problems in chemistry pertinent in engineering applications using phase rule and analytical techniques
CO5	Apply materials and nanomaterials for engineering applications.

Assessment Details

CIE for the Theory component: 30 Marks

	Components	**Number**	**Weightage**	**Max. Marks**
1	Tests (A)	3	60%	18
2	Alternate Assessment Tools(AAT) (B)	3	40%	12
	Total Marks for theory component A+B			30

CIE for the LAB component: 20 Marks

On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.

The laboratory test (duration 02/03 hours) at the end of the 14th /15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for20 marks.

Final CIE Marks (Maximum) for IC Courses = 30 + 20 = 50
SEE for IC Theory for 3 hours duration

The question paper will have ten questions. Each question is set for 20 marks.
There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)
The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IC, the total marks of all questions should not be more than the 30 marks.
SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Wiley Engineering Chemistry, Wiley India Pvt. Ltd. New Delhi, 2013- 2nd Edition.
2. Engineering Chemistry, Satyaprakash& Manisha Agrawal, Khanna Book Publishing, Delhi
3. A Text Book of Engg. Chemistry, Shashi Chawla, Dhanpat Rai & Co. (P) Ltd.
4. Essentials of Physical Chemistry, Bahl&Tuli, S.Chand Publishing
5. Applied Chemistry, Sunita Rattan, Kataria 5. Engineering Chemistry, Baskar, Wiley
6. Engineering Chemistry – I, D. GrourKrishana, Vikas Publishing
7. A Text book of Engineering Chemistry, SS Dara & Dr. SS Umare, S Chand & Company Ltd., 12th Edition, 2011.
8. A Text Book of Engineering Chemistry, R.V. Gadag and Nityananda Shetty, I. K. International Publishing house. 2nd Edition, 2016.
9. Text Book of Polymer Science, F.W. Billmeyer, John Wiley & Sons, 4th Edition, 1999.
10. Nanotechnology A Chemical Approach to Nanomaterials, G.A. Ozin& A.C. Arsenault, RSC Publishing, 2005.
11. Corrosion Engineering, M. G. Fontana, N. D. Greene, McGraw Hill Publications, New York, 3rd Edition, 1996.
12. Linden's Handbook of Batteries, Kirby W. Beard, Fifth Edition, McGraw Hill, 2019.
13. OLED Display Fundamentals and Applications, TakatoshiTsujimura, Wiley–Blackwell , 2012
14. Supercapacitors: Materials, Systems and Applications, Max Lu, Francois Beguin, ElzbietaFrackowiak, Wiley-VCH; 1st edition, 2013.
15. “Handbook on Electroplating with Manufacture of Electrochemicals”, ASIA PACIFIC BUSINESS PRESS Inc., 2017. Dr. H. Panda,
16. Expanding the Vision of Sensor Materials. National Research Council 1995, Washington, DC: The National Academies Press. doi: 10.17226/4782.
17. Engineering Chemistry, Edited by Dr. Mahesh B and Dr. Roopashree B, Sunstar Publisher, Bengaluru, ISBN 978-93-85155-70-3, 2022
18. High Performance Metallic Materials for Cost Sensitive Applications, F. H. Froes, et al. John Wiley & Sons, 2010
19. Instrumental Methods of Analysis, **Dr.K. R.Mahadik** and **Dr.L.Sathiyanarayanan,** NiraliPrakashan, 2020
20. Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, Stanley R. Crouch Seventh Edition, Cengage Learning, 2020
21. Polymer Science, **V R Gowariker,** N V Viswanathan, Jayadev, Sreedhar, Newage Int. Publishers, 4th Edition, 2021
22. Engineering Chemistry, P C Jain & Monica Jain, Dhanpat Rai Publication, 2015-16th Edition.
23. Nanostructured materials and nanotechnology, Hari Singh, Nalwa, academic press, 1st Edition, 2002.
24. Nanotechnology Principles and Practices, Sulabha K Kulkarni, Capital Publishing Company, 3rd Edition 2014
25. Principles of nanotechnology, Phanikumar, Scitech publications, 2nd Edition, 2010.
26. Chemistry for Engineering Students, B. S. Jai Prakash, R. Venugopal, Sivakumaraiah& Pushpa Iyengar., Subash Publications, 5th Edition, 2014
27. “Engineering Chemistry”, O. G. Palanna, Tata McGraw Hill Education Pvt. Ltd. New Delhi, Fourth Reprint, 2015.
28. Chemistry of Engineering materials, Malini S, K S Anantha Raju, CBS publishers Pvt Ltd.,
29. Laboratory Manual Engg. Chemistry, Anupma Rajput, Dhanpat Rai & Co.

Semester: I/II

Course Title: ELEMENTS OF MECHANICAL ENGINEERING

Course Code:	**22EME13/23**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:2:0:0	Exam Hours	03
Total Hours of Pedagogy	40 hours Theory	Credits	03

PRE REQUISITES: Knowledge of Basic Mathematics and Sciences.

Module – 1 **08 Hours**

Introduction to Mechanical Engineering (Overview only):
Role of Mechanical Engineering in Industries and Society- Emerging Trends and Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.
Steam Formation and Application:
Modes of heat transfer, Steam formation, Types of steam, Steam properties and applications of steam (simple numerical problems).
Energy Sources and Power Plants:
Basic working principles of Hydel power plant, Thermal power plant, nuclear power plant, Solar power plant, Tidal power plant and Wind power plant.

Module - 2 **08 Hours**

Machine Tool Operations:
Lathe: Principle of working of a center lathe, lathe operations: Turning, facing, knurling, thread cutting, taper turning by swiveling the compound rest,
Drilling Machine: Working of simple drilling machine, drilling operations: drilling, boring, reaming, tapping, counter sinking, counter boring,
Milling Machine: Working methods of milling (up milling and Down milling), milling operations: plane milling, end milling and slot milling.
(No sketches of machine tools, sketches to be used only for explaining the operations).
Introduction to Advanced Manufacturing Systems: Introduction, components of CNC, advantages and applications of CNC, 3D printing.

Module – 3 **08 Hours**

Introduction to IC Engines: Components and working principles, 4-Stroke Petrol and Diesel engines, Application of IC Engines, performance of IC engines (Simple numerical).
Introduction to Refrigeration and Air Conditioning: Principle of refrigeration, Refrigerants, and their desirable properties. Working principle of VCR and VAR refrigeration system, working principle of room air conditioner & Applications of air Conditioners.

Module - 4 **08 Hours**

Mechanical Power Transmission:
Gear Drives: Types - spur, helical, bevel, worm and rack and pinion, velocity ratio, simple and compound gear trains (simple numerical problems)
Belt Drives: Introduction, Types of belt drives (Flat and V-Belt Drive)
Joining Processes: Soldering, Brazing and Welding, Definitions, classification of welding process, Arc welding, Gas welding, (types of flames), TIG welding, MIG welding, Thermit welding, Laser beam welding and Electron beam welding processes

Module – 5

Mobility technology Electric and Hybrid Vehicles, Components of Electric and Hybrid Vehicles. Advantages and disadvantages of Electric Vehicles (EVs) and Hybrid vehicles.
Introduction to Mechatronics and Robotics: open-loop and closed-loop mechatronic systems. Robot anatomy, Applications of Robots in material handling, processing and assembly and inspection.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Interpret the concepts of mechanical engineering, energy and power generation.
CO2	Elucidate the principles of conventional and advanced manufacturing processes.
CO3	Demonstrate the working principles of IC engines and air-conditioner
CO4	Illustrate the power transmission and joining processes.
CO5	Describe the insights of future mobility and robotics.

Assessment Details

CIE:

	Components	Number	Weight age	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks will be proportionally reduced to 50.
The question paper will have 10 full questions carrying 20 marks each.
There will be 2 full questions (with maximum of four sub questions) from each module.
The students will have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Elements of Mechanical Engineering	K R Gopalakrishna,	Subhash Publications,	2008
2	Elements of Workshop Technology (Vol.1 and Vol.2)	Hazra Choudhry and Nirzar Roy	Media Promotors and Publishers Pvt. Ltd.	2010
3	Elements of Mechanical Engineering	RK Rajput,	Firewall Media	2005
Reference Books				
1	Turbo Machines	M.S. Govinde Gowda and A.M. Nagaraj	M.M. Publications	7th Edition 2012
2	Thermal Science and Engineering	Dr. DS kumar,	SK Kataria and sons Publication, New Delhi.	
3	Manufacturing Technology-Foundry, Forming and Welding,	P.N.Rao.	Tata McGraw Hill3rdEd.,	2003
4	Non-Conventional Energy Sources,	G.D Rai,	Khanna Pulishers,	2003
5	Introduction to Robotics: Mechanics And Control	Craig, J. J., 2nd Ed.	Addison-Wesley Publishing Company, Readong, MA	1989
6	CAD/ CAM/ CIM,	Dr. Radhakrishna P,	3rd edition, New Age International Publishers, New Delhi.	

Semester: II

Course Title: Mathematics for MECHANICAL Stream-II

Course Code:	**22MATM21**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:2:2:0	Exam Hours	03+02
Total Hours of Pedagogy	40 hours Theory + 10-12 Lab Slots	Credits	04

PRE REQUISITES:

Dot and Cross product of vectors, differentiation and Integration.
Definition of Differential Equations, method of solving first order differential equations.
Concept of partial differentiation. Formation of differential equation.
Solving quadratic and cubic equations.
Solving first order and first degree differential equation analytically.

Module-1 Vector Calculus	8 hours
Vector Differentiation: Scalar and vector fields. Gradient, directional derivative, curl and divergence – physical interpretation, solenoidal and irrotational vector fields. Problems. **Vector Integration:** Line integrals, Surface integrals. Applications to work done by a force andflux. Statement of Green's theorem and Stoke's theorem. Problems. **Self-Study:** Volume integral and Gauss divergence theorem. **Applications:** Heat and mass transfer, oil refinery problems, environmental engineering, velocity and acceleration of moving particle, analysis of stream lines. **(RBT Levels: L1, L2 and L3)**	
Module-2 Ordinary Differential Equations of higher order	**8 hours**
Higher-order linear ODE's with constant coefficients - Inverse differential operator, method ofvariation of parameters, Cauchy's and Legendre homogeneous differential equations. Problems. **Self-Study:** Formulation and solution of oscillations of a spring. Finding the solution by the methodof undetermined coefficients. **Applications:** Applications to oscillations of a spring, Mechanical systems and Transmission lines.	
Module-3 Partial Differential Equations (PDE's)	**8 hours**
Formation of PDE's by elimination of arbitrary constants and functions. Solution of non- homogeneous PDE by direct integration. Homogeneous PDEs involving derivative with respect to one independent variable only. Solution of Lagrange's linear PDE. Derivation of one-dimensional heat equation and wave equation. **Self-Study:** Solution of one-dimensional heat equation and wave equation by the method of separation of variables. **Applications:** Vibration of a rod/membrane **(RBT Levels: L1, L2 and L3)**	
Module-4 Numerical methods -1	**8 hours**
Solution of algebraic and transcendental equations - Regula-Falsi and Newton-Raphson methods(only formulae). Problems. Finite differences, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference formula and Lagrange's interpolation formula (All formulae without proof). Problems. **Numerical integration:** Trapezoidal, Simpson's $(1/3)^{rd}$ and $(3/8)^{th}$ rules (without proof). Problems. **Self-Study:** Ramanujan's method, Bisection method, Lagrange's inverse Interpolation, Weddle's rule.Applications: Finding approximate solutions to solve mechanical engineering problems involving numerical data. **(RBT Levels: L1, L2 and L3)**	
Module-5 Numerical methods -2	**8 hours**
Numerical Solution of Ordinary Differential Equations (ODE's): Numerical solution of ordinary differential equations of first order and first degree - Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor-corrector formula (No derivations of formulae). Problems.	

Self-Study: Adam-Bashforth method.
Applications: Finding approximate solutions to solve mechanical engineering problems.
(RBT Levels: L1, L2 and L3).

List of Laboratory experiments (2 hours/week per batch/ batch strength 15)
10 lab sessions + 1 repetition class + 1 Lab Assessment

1	Finding gradient, divergent, curl and their geometrical interpretation
2	Solution of second order differential equations
3	Verification of Green's theorem
4	Solution of one-dimensional heat equation and wave equation
5	Solution of algebraic and transcendental equation by Ramanujan's, Regula-Falsi and Newton-Raphson method
6	Interpolation/Extrapolation using Newton's forward and backward difference formula
7	Computation of area under the curve using Trapezoidal, Simpson's $(1/3)^{rd}$ and $(3/8)^{th}$ rule
8	Develop a program to solve ODE of first order and first degree by Taylor's series and Modified Euler's method
9	Develop a program to solve ODE of first order and first degree by R-K 4^{th} order method
10	Develop a program to solve ODE of first order and first degree by Milne's predictor-corrector method

Suggested software's: Mathematica / MatLab / Python/Scilab

COURSE OUTCOMES:

CO1	Understand the applications of vector calculus refer to solenoidal, irrotational vectors, line integral and surface integral.
CO2	Demonstrate various physical models through higher order differential equations and solve such linear ordinary differential equations.
CO3	Demonstrate partial differential equations and their solutions for physical interpretations.
CO4	Apply the knowledge numerical methods in solving physical and engineering phenomena.
CO5	Use appropriate single and multi-step numerical methods to solve first order ODE arising in flow data design problems.

Assessment Details

CIE for the Theory component: 30 Marks

	Components	Number	Weightage	Max. Marks
1	Tests (A)	3	60%	18
2	Alternate Assessment Tools(AAT) (B)	3	40%	12
	Total Marks for theory component A+B			**30**

CIE for the LAB component: 20 Marks

On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.

The laboratory test (duration 02/03 hours) at the end of the 14th /15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for20 marks.

Final CIE Marks (Maximum) for IC Courses = 30 + 20 = 50
SEE for IC Theory for 3 hours duration

The question paper will have ten questions. Each question is set for 20 marks.

There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)

The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IC, the total marks of all questions should not be more than the 30 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year) Text Books

1. B. S. Grewal: “Higher Engineering Mathematics”, Khanna publishers, 44th Ed., 2021.
2. E. Kreyszig: “Advanced Engineering Mathematics”, John Wiley & Sons, 10th Ed., 2018.

Reference Books

1. V. Ramana: “Higher Engineering Mathematics” McGraw-Hill Education, 11th Ed., 2017
2. Srimanta Pal & Subodh C. Bhunia: “Engineering Mathematics” Oxford University Press, 3rd Ed., 2016.
3. N.P Bali and Manish Goyal: “A textbook of Engineering Mathematics” Laxmi Publications, 10th Ed., 2022.
4. C. Ray Wylie, Louis C. Barrett: “Advanced Engineering Mathematics” McGraw – Hill Book Co., Newyork, 6th Ed., 2017.
5. Gupta C.B, Sing S.R and Mukesh Kumar: “Engineering Mathematic for Semester I and II”, Mc-Graw Hill Education (India) Pvt. Ltd 2015.
6. H. K. Dass and Er. Rajnish Verma: “Higher Engineering Mathematics” S. Chand Publication, 3rd Ed., 2014.
7. James Stewart: “Calculus” Cengage Publications, 7th Ed., 2019.
8. David C Lay: “Linear Algebra and its Applications”, Pearson Publishers, 4th Ed., 2018.
9. Gareth Williams: “Linear Algebra with applications”, Jones Bartlett Publishers Inc., 6th Ed., 2017.

** ** **

Common courses

Semester: I/II
Course Title: Computer Aided Engineering Drawing

Course Code	**22CED13/23**	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:0:2	SEE Marks	50
Credits	03	Exam Hours	03
Total Number of Pedagogy Hours	40	Total Marks	100

Pre-requisites:
Knowledge of basic geometrical shapes and instruments, measurement, unit conversions

Module-1 **10 Hours**

Introduction to Sketching: Principles of Engineering Graphics and their significance, Drawing Instruments and their uses, BIS conventions, free hand sketching, Drawing sheets, Fundamentals of Scales, Introduction to Software (solid edge): Creation of 2D/3D environment, selection of drawing sheet size and scale, different commands, Dimensioning rules, Line Conventions.
Introduction to Orthographic Projections, planes of projection, reference line and conventions employed, First and Third angle of projection,
Orthographic Projections of points situated in all four quadrants.
Orthographic Projection of straight lines located in first quadrant with inclined to VP and HP. Problems on applications of straight lines without traces.
Orthographic Projection of plane surfaces (First angle projection only) Projection of regular plane surfaces- triangle, square, rectangle, pentagon, hexagon and circular laminae in simple positions resting on HP/ VP and inclined to HP/ VP using change of position method. (No problems on punched and composite plates).

Module-2 **10 Hours**

Orthographic Projection of Solids: Introduction, Projections of right regular solids- prisms & pyramids (triangle, square, rectangle, pentagon and hexagon), cones, cubes (hexahedron) and tetrahedron, solids resting on HP ONLY

Module-3 **10 Hours**

Isometric Projection: Introduction, Isometric scale, Isometric projection of- simple plane figures, individual solids and combination of two simple solids, Conversion of Isometric to orthographic views. Problems on applications of Isometric projection of simple Engineering components and conversion to orthographic projections (Mechanical, electrical and electronic components for CIE only).

Module-4 **10 Hours**

Development of Lateral Surfaces of Solids: Development of lateral surfaces of right regular prisms, pyramids, cylinders and cones resting with base on HP only. Development of lateral surfaces of Sphere, frustums and truncation. Problems on applications of Development of lateral surfaces viz, funnel, tray, transition pieces, connecting two ducts.

Module-5 **10 Hours**

Engineering Applications of Engineering Graphics: Sketching and drawing simple Mechanisms, wiring and lighting diagrams, Basic building Drawings, Electronic Drawing- PCB Drawings. Introduction to Development of Computer Graphical Packages

COURSE OUTCOMES:
At the end of the course, the student will be able to:

CO1	Implement the principles of orthographic projections of points, lines and planes,
CO2	Analyze and draw the orthographic projections of solids.
CO3	Draw Isometric projection by visualizing three dimensional objects.
CO4	Develop the lateral surfaces of solids
CO5	Identify the inter-disciplinary engineering components through its graphical representations.

Assessment Details

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks) and that for SEE minimum passing marks is 35% of the maximum marks (18 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Examination / Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B)
The Alternate Assessment Tools are Quiz, Assignments, Presentations, Open Book, Self E- Learning and Model Making.

Semester End Examination (SEE):

The SEE question paper will be set for 100 marks and the marks will be proportionally reduced to 50.

1. The question paper will have 8 full questions from module-1 to module-4 as per below tabled weightage details.
2. The students will have to answer 4 full questions, selecting one full question from each module.

Module	Max. Marks Weightage	Evaluation Weightage in marks	
		Computer display and print out (a)	Preparatory sketching (b)
Module 1	20	13	07
Module 2	30	19	11
Module 3	25	16	09
Module 4	25	16	09
Total	100	64	36
Consideration of SEE Marks		**Total of (a) + (b) □ 2 = Final SEE marks**	

Suggested Learning Resources:

Textbooks				
1	Engineering Drawing: Plane and Solid Geometry	Bhatt, N.D	53rd Edition, Charotar Publishing House Pvt. Limited, Gujarat	2019
2	Engineering Graphics	Gopalakrishna K.R	32nd Edition, Subash Stores, Bangalore	2005
Reference Books				
1	A Textbook of Engineering Drawing	Dhawan R. K	3/e, S. Chand Publishing	2019
2	A Textbook of Engineering Graphics	Venugopal K., and Prabhuraj	New Age International Publishers	2014
3	Engineering Drawing	Parthasarathy N. S., Vela Murali,	Oxford University Press	2015

Semester: I
Course Title: COMMUNICATIVE ENGLISH (22ENG16)

Course Code:	**22ENG16**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	1:0:0:0	Exam Hours	01 Theory
Total Hours of Pedagogy	15 hours	Credits	01

Language Lab:
To augment LSRW, grammar and Vocabulary skills (Listening, Speaking, Reading, Writing and Grammar, Vocabulary) through tests, activities, exercises etc., comprehensive web-based learning and assessment systems can be referred as per the AICTE / VTU guidelines.

Module-1 **03 hours**

Introduction to Communicative English : Communicative English, Fundamentals of Communicative English, Process of Communication, Barriers to Effective Communicative English, Different styles and levels in Communicative English.

Module-2 **03 hours**

Introduction to Phonetics: Phonetic Transcription, Pronunciation Guidelines to consonants and vowels, Silent and Non silent Letters, Syllables and Structure. Word Accent, Stress Shift and Common Errors in Pronunciation.

Module-3 **03 hours**

Basic English Communicative Grammar : Basic English Grammar and Parts of Speech, Articles, Question Tags, Voices and Reported Speech, Tense and Types of tenses,

Module-4 **03 hours**

Essential Vocabulary for Communicative English: Words formation-Prefixes and Suffixes, Contractions and Abbreviations. One Word Substitutes, Synonyms and Antonyms, Word Pairs (Minimal Pairs) Contractions, Collocations.

Module-5 **03 hours**

Communication Skills for Employment: Information Transfer: Oral Presentation and its Practice. Public Speaking Skills-Story Telling, Extempore, and Elocution, Mother Tongue Influence (MTI), Various Techniques for Neutralization of Mother Tongue Influence.

Course outcomes

CO1	Understand and apply the Fundamentals of Communication Skills in their communication skills.
CO2	Identify the nuances of phonetics, intonation and enhance pronunciation skills.
CO3	To impart basic English grammar and essentials of language skills as per present requirement.
CO4	Understand and use all types of English vocabulary and language proficiency.
CO5	Adopt the Techniques of Information Transfer through presentation.

Assessment details:

Continuous Internal Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B) = 30 + 20 = 50

Semester End Examination (SEE)
Question paper pattern:

SEE paper will be set for 50 questions of each of 01 marks. The pattern of the question paper is MCQ. The time allotted for SEE is 01 hour

Suggested Learning Resources:
Textbook:

1. Communication Skills by Sanjay Kumar & Pushp Lata, Oxford University Press India Pvt Ltd-2019.
2. A Textbook of English Language Communication Skills, (ISBN-978-81-955465-2-7), Published by Infinite Learning Solutions, Bengaluru-2022.

Reference Books:

1. Technical Communication by Gajendra Singh Chauhan and Et al, (ISBN-978-93-5350-050-4), Cengage learning India Pvt. Limited Latest Revised Edition-2019.

2. English for Engineers by N.P.Sudharshana and C.Savitha, Cambridge University Press-2018.
3. English Language Communication Skills-Lab Manual cum Workbook, Cengage learning India Pvt Limited [Latest Revised Edition]-(ISBN-978-93-86668-45-5), 2019.
4. A Course in Technical English-D Praveen Sam, KN Shoba, Cambridge University Press-2020.
5. Practical English Usage by Michael Swan, Oxford University Press-2016.

Semester: I/II
Course Title: Indian Constitution

Course Code:	**22ICO17 / 27**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	1:0:0:0	Exam Hours	01 Theory
Total Hours of Pedagogy	15 hours	Credits	01

Module-1	**03 hours**
Indian Constitution: Necessity of the Constitution, Societies before and after the Constitution adoption. Introduction to the Indian constitution, Making of the Constitution, Role of the Constituent Assembly.	
Module-2	**03 hours**
Salient features of India Constitution. Preamble of Indian Constitution & Key concepts of the Preamble. Fundamental Rights (FR's) and its Restriction and limitations in different Complex Situations, building.	
Module-3	**03 hours**
Directive Principles of State Policy (DPSP's) and its present relevance in Indian society. Fundamental Duties and its Scope and significance in Nation, Union Executive: Parliamentary System, Union Executive-President, Prime Minister, Union Cabinet.	
Module-4	**03 hours**
Parliament-LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Judicial System of India, Supreme Court of India and other Courts, Judicial Reviews and Judicial Activism.	
Module-5	**03 hours**
State Executive and Governer, CM, State Cabinet, Legislature-VS & VP, Election Commission, Elections & Electoral Process. Amendment to Constitution, and Important Constitutional Amendments till today. Emergency Provisions.	

Course outcomes

CO1	Understand basic structure of Indian Constitution.
CO2	Remember their Fundamental Rights, DPSP's and Fundamental Duties (FD's) of our constitution.
CO3	Understand about our Union Government, political structure & codes, procedures.
CO4	Understand our State Executive & Elections system of India.
CO5	Remember the Amendments and Emergency Provisions, other important provisions given by the constitution.

Assessment Details (both CIE and SEE)

Continuous Internal Evaluation (CIE):

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B) = 30 + 20 = 50

Semester End Examination (SEE)
Question paper pattern:
SEE paper will be set for 50 questions of each of 01 marks. The pattern of the question paper is MCQ. The time allotted for SEE is 01 hour

Suggested Learning Resources:
Textbook:
1. "Constitution of India" (for Competitive Exams)-Published by Naidhruva Edutech Learning Solutions, Bengaluru.-2022.
2. "Introduction to the Constitution of India", (Students Edition.) by Durga Das Basu (DD Basu): Prentice –Hall, 2008.

Reference Books:

1. “Constitution of India, Professional Ethics and Human Rights” by Shubham Singles, Charles E. Haries, and et al: published by Cengage Learning India, Latest Edition-2019.
2. “The Constitution of India” by Merunandan K B: published by Merugu Publication, Second Edition, Bengaluru.
3. “Samvidhana Odu”-for Students & Youths by Justice HN Nagamohan Dhas, Sahayana, kerekon.
4. M.Govindarajan, S.Natarajan, V.S.Senthilkumar, “Engineering Ethics”, Prentice –Hall, 2004.

Semester: I/II
Course Title: INNOVATION and DESIGN THINKING

Course Code	21IDT18/28	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	1:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	02

Module-1	**03 hours**
PROCESS OF DESIGN **Understanding Design thinking** Shared model in team-based design-Theory and practice in Design thinking-Explore presentation signers across globe-MVP or Prototyping	
Teaching-Learning Process	Introduction about the design thinking: Chalk and Talk method Theory and practice through presentation MVP and Prototyping through live examples and videos
Module-2	**03 hours**
Tools for Design Thinking Real-Time design interaction capture and analysis-Enabling efficient collaboration in digital space-Empathy for design-Collaboration in distributed Design	
Teaching Learning	Case studies on design thinking for real-time interaction and analysis
Process	Simulation exercises for collaborated enabled design thinking Live examples on the success of collaborated design thinking
Module-3	**03 hours**
Design Thinking in IT Design Thinking to Business Process modelling-Agile in Virtual collaboration environment-Scenario based Prototyping	
Teaching-Learning Process	Case studies on design thinking and business acceptance of the design Simulation on the role of virtual eco-system for collaborated prototyping
Module-4	**03 hours**
DT For strategic innovations Growth-Story telling representation-Strategic Foresight-Change-Sense Making-Maintenance Relevance-Value redefinition-Extreme Competition-experience design-Standardization-Humanization-Creative Culture-Rapid prototyping, Strategy and Organization-Business Model design.	
Teaching-Learning Process	Business model examples of successful designs Presentation by the students on the success of design Live project on design thinking in a group of 4 students
Module-5	**03 hours**
Design thinking workshop Design Thinking Work shop Empathize, Design, Ideate, Prototype and Test	
Teaching-Learning Process	8 hours design thinking workshop from the expect and then presentation by the students on the learning from the workshop

COURSE OUTCOMES

CO1	Identify the methods, processes, and tools of Design Thinking
CO2	Apply the Design thinking approach and model to real world situations
CO3	Propose design ideas through different techniques
CO4	Develop technical drawings for design ideas
CO5	Execute innovation driven projects using design thinking principles

Assessment Details (both CIE and SEE)

Continuous Internal Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B) = 30 + 20 = 50
Semester End Examination (SEE)
Question paper pattern:

SEE paper will be set for 50 questions of each of 01 marks. The pattern of the question paper is MCQ. The time allotted for SEE is 01 hour

Suggested Learning Resources:
Text Books:

1. John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design",C engage learning (International edition) Second Edition, 2013.
2. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press , 2009.
3. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand-Improve-Apply", Springer, 2011
4. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013.

References:

1. Yousef Haik and Tamer M.Shahin, "Engineering Design Process", Cengage Learning, Second Edition, 2011.
2. Book-Solving Problems with Design Thinking-Ten Stories of What Works (Columbia Business School Publishing) Hardcover-20 Sep 2013 by Jeanne Liedtka (Author), Andrew King (Author), Kevin Bennett (Author).

Suggested Learning Resources:
Textbook:

1. "Professional Writing Skills in English" published by Fillip Learning-Education (ILS), Bangalore-2022.
2. "Functional English" (As per AICTE 2018 Model Curriculum) (ISBN-978-93-5350-047-4) Cengage learning India Pvt Limited Latest Edition 2019.

Reference Books:

1. English for Engineers by N.P.Sudharshana and C.Savitha, Cambridge University Press-2018.
2. Technical Communication by Gajendra Singh Chauhan and Et al, (ISBN-978-93-5350-050-4), Cengage learning India Pvt Limited Latest Revised Edition-2019.
3. Technical Communication-Principles and Practice, Third Edition by Meenakshi Raman and Sangeetha Sharma, Oxford University Press 2017.
4. High School English Grammar & Composition by Wren and Martin, S Chandh & Company Ltd-2015.
5. Effective Technical Communication-Second Edition by M Ashraf Rizvi, McGraw Hill Education (India) Private

Semester: I/II
Course Title: Scientific Foundations of Health

Course Code:	**22SFH18/28**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	1:0:0:0	Exam Hours	01 Theory
Total Hours of Pedagogy	15 hours	Credits	01

Module-1	**03 hours**
Good Health & It's balance for positive mindset: Health -Importance of Health, Influencing factors of Health, Health beliefs, Advantages of good health, Health & Behavior, Health & Society, Health & family, Health & Personality, Psychological disorders-Methods to improve good psychological health, Changing health habits for good health.	
Module-2	**03 hours**
Building of healthy lifestyles for better future: Developing healthy diet for good health, Food & health, Nutritional guidelines for good health, Obesity & overweight disorders and its management, Eating disorders, Fitness components for health, Wellness and physical function, How to avoid exercise injuries.	
Module-3	**03 hours**
Creation of Healthy and caring relationships: Building communication skills, Friends and friendship-Education, the value of relationship and communication skills, Relationships for Better or worsening of life, understanding of basic instincts of life (more than a biology), Changing health behaviours through social engineering.	
Module-4	**03 hours**
Avoiding risks and harmful habits: Characteristics of health compromising behaviors, Recognizing and avoiding of addictions, How addiction develops, Types of addictions, influencing factors of addictions, Differences between addictive people and non-addictive people & their behaviors. Effects of addictions Such as..., how to recovery from addictions.	
Module-5	**03 hours**
Preventing & fighting against diseases for good health: How to protect from different types of infections, How to reduce risks for good health, Reducing risks & coping with chronic conditions, Management of chronic illness for Quality of life, Health & Wellness of youth :a challenge for upcoming future, Measuring of health & wealth status.	

COURSE OUTCOMES

CO1	Understand and Analyse about Health and wellness (and its Beliefs) & It's balance for positive mindset.
CO2	Develop the healthy lifestyles for good health for their better future.
CO3	Build a Healthy and caring relationships to meet the requirements of good/social/positive life.
CO4	Learn about Avoiding risks and harmful habits in their campus and outside the campus for their bright future.
CO5	Prevent and fight against harmful diseases for good health through positive mindset.

Assessment Details (both CIE and SEE):
Continuous Internal Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B) = 30 + 20 = 50

Semester End Examination (SEE)
Question paper pattern:

SEE paper will be set for 50 questions of each of 01 marks. The pattern of the question paper is MCQ. The time allotted for SEE is 01 hour

Suggested Learning Resources:
Textbook:
1. "Scientific Foundations of Health"-Study Material Prepared by Dr. L Thimmesha, Published in VTU-University Website.
2. "Scientific Foundations of Health", (ISBN-978-81-955465-6-5) published by Infinite Learning Solutions, Bangalore-2022.

3. Health Psychology-A Textbook, FOURTH EDITION by Jane Ogden McGraw Hill Education (India) Private Limited-Open University Press.

Reference Books:

1. Health Psychology (Second edition) by Charles Abraham, Mark Conner, Fiona Jones and Daryl O'Connor-Published by Routledge 711 Third Avenue, New York, NY 10017.
2. HEALTH PSYCHOLOGY (Ninth Edition) by SHELLEY E. TAYLOR-University of California, Los Angeles, McGraw Hill Education (India) Private Limited-Open University Press.
3. SWAYAM / NPTL/ MOOCS/ We blinks/ Internet sources/ YouTube videos and other materials / notes.
4. Scientific Foundations of Health (Health & Welness)-General Books published for university and colleges references by popular authors and published by the reputed publisher.

Semester: II

Course Title: Professional Writing Skills in English

Course Code:	22PWS26	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	1:0:0:0	Exam Hours	01 Theory
Total Hours of Pedagogy	15 hours	Credits	01

Module-1	**(03 hours)**
Identifying Common Errors in Writing and Speaking English: Common errors identification in parts of speech, Usage of verbs and phrasal verbs, Auxiliary verbs and their forms, Subject Verb Agreement (Concord Rules), Common errors in Subject-verb agreement, Sequence of Tenses and errors identification in Tenses.	
Module-2	**(03 hours)**
Nature and Style of sensible writing: Paragraph Writing: Rules of Paragraph writing, Importance of Proper Punctuation, Precise writing and Techniques in Essay writing, Sentence arrangements, Misplaced modifiers, Word Order, Errors due to the Confusion of words.	
Module-3	**(03 hours)**
Technical Reading and Writing Practices: Technical writing process, Introduction to Technical Reports writing, Significance of Reports, Types of Reports. Introduction to Technical Proposals Writing, Types of Technical Proposals, Characteristics of Technical Proposals. Scientific Writing Process. Grammar –Spotting Error & Sentence Improvement, Cloze Test and Theme Detection Exercises.	
Module-4	**(03 hours)**
Professional Communication for Employment: Listening Comprehension, Types of Listening, Listening Barriers, Improving Listening Skills. Reading Comprehension, Tips for effective reading. Job Applications, Types of official/employment/business Letters, Resume vs. Bio Data, Profile, CV. Writing effective resume for employment, Emails, Blog Writing and Memos.	
Module-5	**(03 hours)**
Professional Communication at Workplace: Group Discussion and Professional Interviews: Characteristics and Strategies. Intra and Interpersonal Communication Skills at workplace, Importance of Non-Verbal Communication skills in GD and Interview, Presentation skills and Formal Presentations by Students, Strategies of Presentation Skills.	

Course outcome

At the end of the course the student will be able to:

CO1	Identify the Common Errors in Writing and Speaking.
CO2	Develop Technical writing skills.
CO3	Improve nature and style of sensible writing skills at work place
CO4	Improve their technical communication skills through reading and writing practices
CO5	Perform well in campus recruitment, engineering and all other general competitive examinations

Assessment Details (both CIE and SEE)

Continuous Internal Evaluation (CIE):

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B) = 30 + 20 = 50

Semester End Examination (SEE)

Question paper pattern:

SEE paper will be set for 50 questions of each of 01 marks. The pattern of the question paper is MCQ. The time allotted for SEE is 01 hour.

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ENGINEERING SCIENCE COURSE I/II

Semester: I/II
Course Title: Introduction to Civil Engineering

Course Code:	**22ESC141/241**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:2:0:0	Exam Hours	03
Total Hours of Pedagogy	25 hrs Lecture+25 hrs Tutorial = 50 hrs	Credits	03

Module-1 **10 Hours**

Civil Engineering Disciplines and Building Science
Introduction to Civil Engineering: Surveying, Structural Engineering, Geotechnical Engineering, Hydraulics & Water Resources, Transportation Engineering, Environmental Engineering, Construction planning & Project management.

Basic Materials of Construction: Bricks, Cement & mortars, Plain, Reinforced & Pre-stressed Concrete, Structural steel, Construction Chemicals.
Structural elements of a building: foundation, plinth, lintel, chejja, Masonry wall, column, beam, slab and staircase

Module-2 **10 Hours**

Societal and Global Impact of Infrastructure
Infrastructure: Introduction to sustainable development goals, Smart city concept, clean city concept, Safe city concept
Environment: Water Supply and Sanitary systems, urban air pollution management, Solid waste management, identification of Landfill sites, urban flood control Built-environment: Energy efficient buildings, recycling, Temperature and Sound control in buildings, Security systems; Smart buildings.

Module-3 **10 Hours**

Analysis of force systems: Concept of idealization, system of forces, principles of superposition and transmissibility, Resolution and composition of forces, Law of Parallelogram of forces, Resultant of concurrent and non-concurrent coplanar force systems, moment of forces, couple, Varignon’s theorem, free body diagram, equations of equilibrium, equilibrium of concurrent and non-concurrent coplanar force systems

Module-4 **10 Hours**

Centroid: Importance of centroid and centre of gravity, methods of determining the centroid, locating the centroid of plane laminae from first principles, centroid of built-up sections. Numerical examples

Module-5 **10 Hours**

Moment of inertia: Importance of Moment of Inertia, method of determining the second moment of area (moment of inertia) of plane sections from first principles, parallel axis theorem and perpendicular axis theorem, section modulus, radius of gyration, moment of inertia of built-up sections, Numerical Examples.

Course Outcomes:
CO1 Apply the fundamental knowledge of Civil Engineering in its various Disciplines and Building Sciences.
CO2 Illustrate the effect of infrastructure on societal & global impact for sustainable development
CO3 Compute the resultant and equilibrium of force systems.
CO4 Locate the centroid of plane and built-up sections.
CO5 Compute the moment of inertia of plane and built-up sections.

Assessment Details

CIE:

	Components	Number	Weight age	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B)
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks will be proportionally reduced to 50.

The question paper will have 10 full questions carrying 20 marks each.

There will be 2 full questions (with maximum of four sub questions) from each module.

The students will have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

Text Books

Bansal R. K., Rakesh Ranjan Beohar and Ahmad Ali Khan, Basic Civil Engineering and Engineering Mechanics, 2015, Laxmi Publications.

Kolhapure B K, Elements of Civil Engineering and Engineering Mechanics, 2014, EBPB

Reference Books:

1. Beer F.P. and Johnston E. R., Mechanics for Engineers, Statics and Dynamics, 1987, McGraw Hill.
2. Irving H. Shames, Engineering Mechanics, 2019, Prentice-Hall.
3. Hibbler R. C., Engineering Mechanics: Principles of Statics and Dynamics, 2017, Pearson Press.
4. Timoshenko S, Young D. H., Rao J. V., Engineering Mechanics, 5th Edition, 2017, Pearson Press.
5. Bhavikatti S S, Engineering Mechanics, 2019, New Age International Reddy Vijaykumar K and Suresh Kumar K, Engineer

Semester: I/II
Course Title: Introduction to Electrical Engineering

Course Code	**22ESC142/242**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P:S)	3:0:0:0	Exam Hours	03
Total Hours of Pedagogy	40 hours	Credits	03

Module-1 **08 Hours**

DC Circuits: Ohm's Law and its limitations. KCL & KVL, series, parallel, series-parallel circuits. Simple Numericals.
Electromagnetism: Faraday's Laws of Electromagnetic Induction, Lenz's Law, Flemings rules, statically and dynamically induced EMF; concepts of self and mutual inductance. Simple Numerical.

Module-2 **08 Hours**

A.C. Fundamentals:
Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor. (only definitions) Voltage and current relationship with phasor diagrams in R, L, and C circuits. Concept of Impedance. Analysis of R-L, R-C, R-L-C Series circuits. Active power, reactive power and apparent power. Concept of power factor. (Simple Numerical).

Module-3 **08 Hours**

Transformers: Necessity of transformer, principle of operation, Types and construction of single phase transformers, EMF equation, losses, variation of losses with respect to load. Efficiency and simple numerical.
Three-phase induction Motors: Concept of rotating magnetic field, Principle of operation, constructional features of motor, types – squirrel cage and wound rotor. Slip and its significance simple numerical.

Module-4 **08 Hours**

Three Phase Synchronous Generators: Construction details, principle of operation, EMF equation (excluding derivations of pitch factor and distribution factor).
Electric power Generation: Conventional and non-conventional energy resources; General structure of electrical power systems using single line diagram approach. Power Generation: Hydel, Nuclear, Solar & wind power generation (Block Diagram approach).

Module-5 **08 Hours**

Domestic Wiring: Requirements, Types of wiring: casing, capping. Two-way and three-way control of load.
Electrical Energy Consumption: Power rating of household appliances including air conditioners, PCs, laptops, printers, etc. Definition of "unit" used for consumption of electrical energy, two-part electricity tariff, calculation of electrical energy consumption for domestic loads.
Equipment Safety measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits.
Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

Outcomes
At the end of the course the student will be able to:
CO1 Solve the problems related to DC circuits and Electromagnetism.
CO2 Analyze the single phase AC circuits.
CO3 Explain the construction, operation and applications of transformer and induction motor.
CO4 Discuss the various conventional Electric power generation.
CO5 Describe the concepts of domestic wiring, electricity billing, circuit protective devices and personal safety measures.

Assessment Details

CIE:

	Components	Number	Weight age	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B)
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks will be proportionally reduced to 50.
The question paper will have 10 full questions carrying 20 marks each.
There will be 2 full questions (with maximum of four sub questions) from each module.

The students will have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)
Text Books:
1. Basic Electrical Engineering by D C Kulshreshtha, Tata McGraw Hill, First Edition 2019.
2. A text book of Electrical Technology by B.L. Theraja, S Chand and Company, reprint edition 2014.

Reference Books:
1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Tata McGraw Hill 4th edition, 2019.
2. Principles of Electrical Engineering & Electronics by V. K. Mehta, Rohit Mehta, S. Chand and Company Publications, 2^{nd} edition, 2015.
3. Fundamentals of Electrical Engineering by Rajendra Prasad, PHI, 3rd edition, 2014.

Semester: I/II
Course Name: Introduction to Electronics Engineering

Course Code	**22ESC143/243**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Pre-requisites: Basics of Semiconductor Physics and Mathematics, Logical reasoning skills.

Module – 1 **08 Hours**

Introduction to Passive Components: Role of R, L and C components in Electronic circuits.
Semiconductor Diodes: Introduction, PN Junction diode, Characteristics and Parameters, Half-wave rectifier, Full-wave rectifiers, Zener Diode - Junction Breakdown, Circuit Symbol and Characteristics.
Power Supplies–Block diagram, Rectifiers, Filters, Voltage regulators, Output resistance and voltage regulation.

Self-Study topics: Diode as a Switch, Avalanche Break down.

Module - 2 **08 Hours**

Amplifiers: Types of amplifiers, Parameters of amplifiers, Phase shift, Negative feedback, Multi-stage amplifiers.
Oscillators: Positive feedback, Conditions for oscillations, Ladder network oscillator, Wein bridge oscillator, Crystal controlled oscillators, Astable Multivibrator.
Operational amplifiers- Ideal op-amp; characteristics of ideal and practical op-amp; Practical op- amp circuits: Inverting and non-inverting amplifiers, voltage follower, summer, subtractor, integrator, differentiator.(Text 1)

Self-Study topics: BJT as a Switch, IC 555 Timer.

Module – 3 **08 Hours**

Boolean Algebra and Logic Circuits: Binary numbers, Number Base Conversion, octal & Hexa Decimal Numbers, Complements, Basic definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Other Logic Operations, Digital Logic Gates
(Text 2: 1.2, 1.3, 1.4, 1.5,2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7)
Combinational logic: Introduction, Design procedure, Adders- Half adder, Full adder (Text 2:4.1,4.2, 4.3)
Sequential logic: Introduction, RS, JK, D and T Flip-flops, Shift registers, Counters.

Self-Study topics: Logic Families, Multiplexers, Encoders/Decoders.

Module – 4 **08 Hours**

Embedded Systems – Definition, Embedded systems vs general computing systems, Classification of Embedded Systems, Major application areas of Embedded Systems, Elements of an Embedded System, Core of the Embedded System, Microprocessor vs Microcontroller, RISC vs CISC
Sensors and Interfacing – Instrumentation and control systems, Transducers, Sensors, Actuators, LED, 7-Segment LED Display. (Text 1)

Self-Study topics: Case study on Embedded applications.

Module – 5 **08 Hours**

Analog Communication Schemes: Modern communication system scheme, Information source, and input transducer, Transmitter, Channel or Medium – Hardwired and Soft wired, Noise, Receiver, Multiplexing, Types of communication systems. Types of modulation (only concepts) – AM , FM, Concept of Radio wave propagation (Ground, space, sky)
Digital Modulation Schemes: Advantages of digital communication over analog communication, ASK, FSK, PSK, Radio signal transmission Multiple access techniques. (Text 3)

Self-Study topics: Wireless communication technologies.

Course Outcomes:

Upon completion of this course, student will be able to:

1. Analyze the role of active and passive electronic components in the development of rectifiers and voltage regulators as a part of power supply design.
2. Apply the acquired knowledge to construct amplifiers and oscillators using semiconductor devices.
3. Apply the fundamental knowledge of digital logic to realize the applications of combinational and sequential circuits.
4. Interpret the characteristics and technological advances of embedded systems associated with sensors and actuators.
5. Relate the analog and digital communication engineering concepts, spanning from frequency spectrum, basic modulation concepts and radio wave propagation to the applications of contemporary communication systems.

Assessment Details

CIE:

	Components	Number	Weight age	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks will be proportionally reduced to 50.

1. The question paper will have 10 full questions carrying 20 marks each.
2. There will be 2 full questions (with maximum of four sub questions) from each module.
3. The students will have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Electronic Circuits, Fundamentals & Applications’	Mike Tooley	Elsevier	4th Edition & 2015
2	Digital Logic and Computer Design	M. Morris Mano	PHI Learning	2008
3	Basic Electronics’	D P Kothari, I J Nagrath	McGraw Hill Education (India),Private Limited	2nd Edition, 2018

Semester: I/II
Course Name: INTRODUCTION TO MECHANICAL ENGINEERING

Course Code	**22ESC144/244**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Credits	3	Exam Hours	03
Total Hours of Pedagogy	40	Total Marks	100

Module – 1 **08 Hours**

Introduction to Emerging Technologies
Introduction: Role of Mechanical Engineering in Industries and Society- Emerging Trends and Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.
Energy Sources and Power Plants: Review of energy sources; Construction and working of Hydel power plant, Thermal power plant, Solar power plant by photovoltaic (PV) cell, Wind power plant.

Module - 2 **08 Hours**

Energy and I C Engine
Introduction to IC Engines: Components and Working Principles, 4-Strokes Petrol and Diesel Engines, Application of IC Engines.
Insight into Future Mobility Electric and Hybrid Vehicles, Components of Electric and Hybrid Vehicles. Advantages and disadvantages of EVs and Hybrid vehicles

Module – 3 **08 Hours**

Machine Tool Operations:
Lathe: Principle of working of a center lathe, lathe operations: Turning, facing, knurling, thread cutting, taper turning by swiveling the compound rest,
Drilling Machine: Working of simple drilling machine, drilling operations: drilling, boring, reaming, tapping, counter sinking, counter boring,
Milling Machine: Working, milling methods (Up milling down milling) operations milling: plane milling, end milling and slot milling.
Introduction to Advanced Manufacturing Systems: Introduction, components of CNC, advantages and applications of CNC

Module - 4 **08 Hours**

Engineering Materials: Types and applications of Ferrous & Nonferrous Metals, silica, ceramics, graphite, and polymer. Shape Memory Alloys.
Joining Processes: Soldering, Brazing and Welding, Definitions, classification of welding process, Arc welding, Gas welding and types of flames.

Module – 5 **08 Hours**

Introduction to Mechatronics and Robotics: open-loop and closed-loop mechatronic systems. Classification based on robotics configuration: polar cylindrical, Cartesian coordinate and spherical. Application, Advantages and disadvantages.
Automation in industry: Definition, types - Fixed, programmable and flexible automation, advantages and disadvantages.
Evolution of technologies Introduction to Industrial revolution, Fourth industrial revolution (IR 4.0) Industrial IOT definition, merit, demerit and application.

Course Outcomes:
Upon completion of this course, student will be able to:

CO1	Explain the concepts of Mechanical Engineering and Energy sources
CO2	Describe the principles of IC engine and insights of future mobility
CO3	Elucidate the principles of conventional and advanced manufacturing processes.
CO4	Identify the Engineering Materials and joining processes
CO5	Discuss the concepts of automation and evolution technologies.

Assessment Details

CIE:

	Components	Number	Weight age	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks will be proportionally reduced to 50.
The question paper will have 10 full questions carrying 20 marks each.
There will be 2 full questions (with maximum of four sub questions) from each module.
The students will have to answer 5 full questions, selecting one full question from each module.

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
	Textbooks			
1	Elements of Mechanical Engineering,	K R Gopalakrishna,	Subhash Publications,	2008
2	Elements of Workshop Technology (Vol.1andVol.2)	Hazra Choudhry and Nirzar Roy	Media Promoter's and Publishers Pvt. Ltd.	2010
3	Elements of Mechanical Engineering	RK Rajput,	Firewall Media	2005
	Reference Books			
1	Turbo Machines	M.S.Govinde Gowda and A.M. Nagaraj	M.M.Publications7Th Edition	2012
2	Thermal Science and Engineering	Dr. DS Kumar,	SK Kataria and sons Publication, New Delhi.	
3	Manufacturing Technology-Foundry, Forming and Welding,	P. N. Rao.	Tata McGraw Hill 3rd Ed.,	2003
4	Non-Conventional Energy Sources,	G.D Rai,	Khanna Publishers,	2003
5	Introduction to Robotics: Mechanics And Control, ,	Craig, J. J., 2nd Ed.	Addison-Wesley Publishing Company, Reading, MA	1989
6	CAD/ CAM/ CIM,	Dr. Radhakrishna P,	3rd edition, New Age International Publishers, New Delhi.	

Semester: I/II
Course Title: Introduction to C Programming

Course Code:	**22ESC145/245**	CIE Marks	50
Course Type (Theory/Practical /Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:0:2:0	Exam Hours	03
Total Hours of Pedagogy	40 hours	Credits	03

Module-1	**6 Hours**
Introduction to C: Introduction to computers, input and output devices, designing efficient programs. Introduction to C, Structure of C program, Files used in a C program, Compilers, Compiling and executing C programs, variables, constants, Input/output statements in C, **Textbook: Chapter 1.1-1.□, 2.1-2.2, 8.1 – 8.6, □.1-□.14**	
Teaching-Learning Process	Chalk and talk method/Power Point Presentation
Module-2	**6 Hours**
Operators in C, Type conversion and typecasting. Decision control and Looping statements: Introduction to decision control statements, Conditional branching statements, iterative statements, nested loops, break and continue statements, goto statement. **Textbook: Chapter □.15-□.16, 10.1-10.6**	
Teaching-Learning Process	Chalk and talk method/Power Point Presentation
Module-3	**6 Hours**
Arrays: Declaration of arrays, accessing the elements of an array, storing values in arrays, Operations on arrays, Passing arrays to functions, **Functions:** Introduction to functions, Function definition, function declaration, function call, return statement, passing parameters to functions, scope of variables, storage classes, recursive functions. **Textbook: Chapter 11.1-11.13, 12.1-12.6**	
Teaching-Learning Process	Chalk and talk method/Power Point Presentation
Module-4	**6 Hours**
Two dimensional arrays, operations on two-dimensional arrays, two-dimensional arrays to functions, multidimensional arrays. Applications of arrays and introduction to strings: Applications of arrays, case study with sorting techniques. Introduction to strings: Reading strings, writing strings, summary of functions used to read and write characters. Suppressing input using a Scanset. **Textbook: Chapter 12.7-12.12**	
Teaching-Learning Process	Chalk and talk method/Power Point Presentation
Module-5	**6 Hours**
Strings: String taxonomy, operations on strings, Miscellaneous string and character functions, arrays of strings. Pointers: Understanding the Computer's Memory, Introduction to Pointers, Declaring Pointer Variables Structures: Introduction to structures **Textbook: Chapter 13.1-13.6, 14.1-14.3,15.1**	
Teaching-Learning Process	Chalk and talk method/Power Point Presentation

Lab Assignments

1	C Program to find Mechanical Energy of a particle using E = mgh+1/2 mv2.
2	C Program to convert Kilometers into Meters and Centimeters.
3	C Program To Check the Given Character is Lowercase or Uppercase or Special Character.
4	Program to balance the given Chemical Equation values x, y, p, q of a simple chemical equation of the type: The task is to find the values of constants b1, b2, b3 such that the equation is balanced on both sides and it must be the reduced form.
5	Implement Matrix multiplication and validate the rules of multiplication
6	Compute sin(x)/cos(x) using Taylor series approximation. Compare you result with the built-in library function. Print both the results with appropriate inferences.
7	Sort the given set of N numbers using Bubble sort.

8	Write functions to implement string operations such as compare, concatenate, string length. Convince the parameter passing techniques.
9	Implement structures to read, write and compute average-marks and the students scoring above and below the average marks for a class of N students
10	Develop a program using pointers to compute the sum, mean and standard deviation of all elements stored in an array of N real numbers.

Course Outcomes

At the end of the course the student will be able to:

1	Identify and name the hardware components of Computer.
2	Apply programming constructs of C language to solve the real world problem
3	Write a program to emphasis use of arrays by implementing solutions to problems like searching and sorting
4	Write a program to emphasis uses of structures, pointers and files to implement solutions to the problems.
5	Design and Develop Solutions to problems using modular programming constructs.

Assessment Details

CIE for the Theory component: 30 Marks

	Components	Number	Weightage	Max. Marks
1	Tests (A)	3	60%	18
2	Alternate Assessment Tools(AAT) (B)	3	40%	12
	Total Marks for theory component A+B			30

CIE for the LAB component: 20 Marks

On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.

The laboratory test (duration 02/03 hours) at the end of the 14th /15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for20 marks.

Final CIE Marks (Maximum) for IC Courses = 30 + 20 = 50

SEE for IC Theory for 3 hours duration

The question paper will have ten questions. Each question is set for 20 marks.

There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)

The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IC, the total marks of all questions should not be more than the 30 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Textbooks

1. Computer fundamentals and programming in C, "Reema Thareja", Oxford University, Second edition, 2017.

Reference Books:

1. E. Balaguruswamy, Programming in ANSI C, 7th Edition, Tata McGraw-Hill.
2. Brian W. Kernighan and Dennis M. Ritchie, The C' Programming Language,

EMERGING TECHNOLOGY COURSES I/II

Semester: I/II

Course Name: SMART MATERIALS AND SYSTEM

Course Code	**22ETC15A/25A**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:0	SEE Marks	50
Total Hours of Teaching-Learning	40	Total Marks	100
Credits	03	Exam Hours	03

Pre-requisites: Knowledge of Basic mathematics and sciences.

Module-1 **08 Hours**

Emerging Materials Honey comb structure (Carbon composites), Nano-materials, engineered polymers, emerging sustainable by products (Fly ash and GGBS) and construction chemicals.

Module-2 **08 Hours**

Prefabricated/ Manufactured building components Definition, types of prefabricated/ manufactured building components and infrastructure, modular coordination, standardization, materials, systems, production, transportation and installation.

Module-3 **08 Hours**

Smart Materials: Definition, Principles of Piezo-electricity, materials (Polymers and Ceramics), sensors (Piezo-electric sensor, strain gauge, shear sensor) smart composites, Overview Magneto rheological Fluids, Magnetostrictive and shape memory Materials.

Module-4 **08 Hours**

Actuators, Piezoelectric Ceramic, Functional Gradient
Introduction, Actuators, Piezoelectric Ceramics, Functionally Graded Materials.
Electro-ceramics: Introduction Electro-ceramics and Smart Systems Electromechanical Actuators, Actuator Materials

Module-5 **08 Hours**

3-D Printing Importance, Historic development, advantages, common terminologies, classification, Process chain, 3-D modeling, Data conversion and transmission, checking and preparation, Building, Post processing, Applications

COURSE OUTCOMES:
At the end of the course, the student will be able to:

CO1	Identify the use of emerging materials for construction
CO2	Analyze the proper prefabricated building components
CO3	Recommend smart materials and methods in building construction
CO4	Develop smart materials and shape memory alloys in building actuators
CO5	Create 3-D modeling and manufacture building component

Assessment Details
CIE:

	Components	**Number**	**Weight age**	**Max. Marks**
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B)
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks will be proportionally reduced to 50.
The question paper will have 10 full questions carrying 20 marks each.
There will be 2 full questions (with maximum of four sub questions) from each module.
The students will have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

Text Books

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Essentials of Materials Science and Engineering,	Donald R. Askeland and Pradeep P. Fulay	Cengage Learning	2009,
2	Smart Materials Volume 1 And Volume 2	I Schwartz, Mel M.	A Wiley-Interscience Publication John Wiley & Sons, Inc. The Encyclopedia of Smart Materials is available Online at www.interscience.wiley.com/reference/esm	ISBN 0-471-17780-6 (cloth : alk.paper)
3	Materials Science and Engineering	Callister Jr, W.D., Rethwisch, D.G.,	Hoboken, NJ: Wiley	10th Ed., 2018

Reference Books

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Engineering Materials 1: An Introduction to Properties, Application and Design	Jones, D.R.H., and Ashby,M.F	Butterworth-Heinemann	4th Ed., 2011
2	Engineering Materials 2: An Introduction to Microstructure and Processing	Jones, D.R.H., and Ashby,M.F	Butterworth-Heinemann	4th Ed., 2012
3	Physical Metallurgy Principles	Abbaschian, R., Abbaschian, L., Reed-Hill, R. E	Cengate Learning	4th Ed., 2009

Semester: I/II

Course Name: GREEN BUILDINGS

Course Code:	**22ETC15B/25B**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	3:0:0:0	Exam Hours	03
Total Hours of Pedagogy	40 hours	Credits	03

Module-1	**08 Hours**
Introduction to the concept of cost effective construction -Uses of different types of materials and their availability -Stone and Laterite blocks- Burned Bricks- Concrete Blocks- Stabilized Mud Blocks- LimePoszolana Cement- Gypsum Board-Fiber Reinforced Cement Components- Fiber Reinforced Polymer Composite-Availability of different materials-Recycling of building materials-Brick- Concrete- Steel- Plastics.	
Module-2	**08 Hours**
Environment friendly and cost effective Building Technologies-Different substitute for wall construction Flemish Bond-Rat Trap Bond-Arches-Panels-Cavity Wall-Ferro Cement and Ferro Concrete constructions-different pre cast members using these materials-Wall and Roof Panels-Beams-columns-Door and Window frames-Water tanks-Septic Tanks-Alternate roofing systems-Filler Slab-Composite Beam and Panel Roof -Pre-engineered and ready to use building elements-wood products-steel and plastic- Costford-Nirmithi Kendra-Habitat	
Module-3	**08 Hours**
Global Warming-Definition-Causes and Effects-Contribution of Buildings towards Global Warming-Carbon Footprint-Global Efforts to reduce carbon Emissions Green Buildings-Definition-Features- Necessity-Environmental benefit-Economical benefits-Health and Social benefits-Major Energy efficient areas for buildings –Comparison of Initial cost of Green V/s Conventional Building-Life cycle cost of Buildings.	
Module-4	**08 Hours**
Green Building rating Systems- BREEAM-LEED-GREEN STAR -GRIHA (Green Rating for Integrated Habitat Assessment) for new buildings-Purpose-Key highlights-Point System with Differential weight age. Green Design-Definition-Principles of sustainable development in Building Design-Characteristics of Sustainable Buildings-Sustainably managed Materials.	
Module-5	**08 Hours**
Utility of Solar Energy in Buildings Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings. Green Composites for Buildings Concepts of Green Composites. Water Utilization in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment.	

COURSE OUTCOMES

CO1 Select different building materials for construction
CO2 Apply effective environmental friendly building technology
CO3 Analyze global warming due to different materials in construction
CO4 Analyse buildings for green rating
CO5 Use alternate source of energy and effective use water

Assessment Details
CIE:

	Components	**Number**	**Weight age**	**Max. Marks**
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks will be proportionally reduced to 50.
The question paper will have 10 full questions carrying 20 marks each.

There will be 2 full questions (with maximum of four sub questions) from each module.
The students will have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:
Text Books
HarharaIyer G, Green Building Fundamentals, Notion Press
Dr. Adv. HarshulSavla, Green Building: Principles & Practices

Semester: I/II
Course Name: RENEWABLE ENERGY SOURCES

Course Code	**22ETC15E/25E**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P:S)	3:0:0:0	Exam Hours	03
Total Hours of Pedagogy	40 hours	Credits	03

Pre-requisites:

Students should have basic knowledge of
Renewable and non-renewable energy sources.
Construction and operation of solar PV cell.
Working principle of turbine and generators.
Laws of thermodynamics.

Module-1	**08 Hours**
Introduction: Principles of renewable energy; energy and sustainable development, fundamentals and social implications. worldwide renewable energy availability, renewable energy availability in India, brief descriptions on solar energy, wind energy, tidal energy, wave energy, ocean thermal energy, biomass energy, geothermal energy, oil shale. Introduction to Internet of energy (IOE).	
Module-2	**08 Hours**
Solar Energy: Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Solar radiation Measurements- Pyrheliometers, Pyrometer, Sunshine Recorder. Solar Thermal systems: Flat plate collector; Solar distillation; Solar pond electric power plant. Solar electric power generation- Principle of Solar cell, Photovoltaic system for electric power generation, advantages, Disadvantages and applications of solar photovoltaic system.	
Module-3	**08 Hours**
Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, Basic components of wind energy conversion system (WECS); Classification of WECS- Horizontal axis- single, double and muliblade system. Vertical axis- Savonius and darrieus types. Biomass Energy: Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies -fixed dome; Urban waste to energy conversion; Biomass gasification (Downdraft).	
Module-4	**08 Hours**
Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, advantages and limitations. Ocean Thermal Energy Conversion: Principle of working, OTEC power stations in the world, problems associated with OTEC.	
Module-5	**08 Hours**
Green Energy: Introduction, Fuel cells: Classification of fuel cells-H2; Operating principles, Zero energy Concepts. Benefits of hydrogen energy, hydrogen production technologies (electrolysis method only), hydrogen energy storage, applications of hydrogen energy, problem associated with hydrogen energy.	

Outcome

At the end of the course the student will be able to:

CO1	Explain the energy scenario in the world and India, merits and demerits of renewable energy resources over the various conventional energy resources.
CO2	Demonstrate the use of solar energy and the various components used in the energy production with respect to applications like-heating, cooling, desalination, power generation.
CO3	Explain the energy conversion principles of wind and tidal power.
CO4	Describe the concept of biomass energy resources and green energy.
CO5	Explain the basic knowledge of ocean thermal energy conversion and hydrogen energy.

Assessment Details
CIE:

	Components	Number	Weight age	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B)
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks will be proportionally reduced to 50.
The question paper will have 10 full questions carrying 20 marks each.
There will be 2 full questions (with maximum of four sub questions) from each module.
The students will have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Rai. G.D., "Non-Conventional Energy Sources", Khanna Publishers, New Delhi, 2011.
2. B. H. Khan, Non-Conventional Energy Resources, The McGraw Hill.
3. Twidell, J.W. & Weir, A. Renewable Energy Sources, EFN Spon Ltd., UK, 2006.
4. S. P. Sukhatme and J.K. Nayak, Solar Energy-Principles of Thermal Collection and Storage, Tata McGraw-Hill, New Delhi.
5. Garg, Prakash, Solar Energy, Fundamentals and Applications, Tata McGraw Hill.

Semester: I/II
Course Name: Introduction to Drone Technology

Course Code	**22ETE15F/25F**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P:S)	3:0:0:0	Exam Hours	03
Total Hours of Pedagogy	40 hours	Credits	03

Module-1
INTRODUCTION TO DRONE - Definition of drones, History of drones, Classification of drones based on structure-Fixed wing structure, Lighter than air systems and Rotary-wing aircraft, Application of drones, Parts of Drone system, System design, Mechanical design, hardware design, software architecture Logistic and Operations Management.

Module-2
DYNAMICS AND STABILITY - Forces of flight, Principal axes and rotation of aerial systems
Longitudinal axis, Lateral (transverse) axis and Perpendicular axis, Equilibrium, Stability-Stable system Unstable system and Neutrally stable system, Control-Roll, Pitch, Yaw and Throttle.

Module-3
REMOTE SENSING - Definition, types of remote sensing, components of remote sensing, electromagnetic spectrum, Black body, Atmospheric windows, energy interaction with earth surface features. Spectral reflectance curve. Platforms and sensors. Sensor resolutions. Types of satellites- Indian and other remote sensing satellites (IRS, IKONS and Landsat). Principle of visual interpretation-key elements.

Module-4
GEOGRAPHIC INFORMATION SYSTEM- Introduction, Functions and advantages, sources of data for GIS. Database-Types, advantages and disadvantages. Data Analysis.-overlay operations, network analysis, spatial analysis. Outputs and map generation. GPS- components and working principles.

Module-5
PHOTOGRAMMETRY: Introduction types of Photogrammetry, Advantages Photogrammetry, Introduction to digital Photogrammetry. Aerial Photogrammetry: Advantages over ground survey methods- geometry of vertical photographs, scales of vertical photograph. Ground coordination- relief displacement, scale ground coordinates-flight planning.

Course Outcomes

CO1	Illustrate the fundamentals of Drone and its application in Surveying
CO2	Determine the dynamic forces and stability systems of Drones
CO3	Create detailed visualizations using an understanding of drone image capture techniques.
CO4	Analyse the spatial data by using GIS tools to create maps and images.
CO5	Apply the theory of photogrammetric to solve measurement problems.

Assessment Details
CIE:

	Components	Number	Weight age	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B)
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other co-operative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks will be proportionally reduced to 50.

The question paper will have 10 full questions carrying 20 marks each.

There will be 2 full questions (with maximum of four sub questions) from each module.

The students will have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources: Books

Geographic Information System-An Introduction, Tor Bernharadsen, 2009, 3rd Edition, Wiley India Pvt. Ltd. New Delhi, ISBN-9788126511389.

Principles of Remote sensing and Image Interpretation, Lillesand and Kiefer, 2011, 6th Edition, John Wiley Publishers, New Delhi, ISBN-8126532238.

Higher Surveying, Chandra A.M, 2015, 3rd Edition, New age international (P) Ltd, ISBN:8122438121

Gonzalez & Woods, Digital Image Processing, 3rd ed., Pearson educa tion, 2008

PK Garg, Introduction To Unmanned Aerial Vehicles, New Age International Publishers New Age International Private Limited; First edition (1 October 2020); NEW AGE International Pvt Ltd

Semester: I/II

Course Name: INTRODUCTION TO SUSTAINABLE ENGINEERING

Course Code	**22ETC15G/25G**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Credits	03	Exam Hours	03
Total Number of Pedagogy Hours	40	Total Marks	100

Pre-requisites:

Module-1 **08 Hours**

Sustainable Development and Role of Engineers: Introduction, Why and What is Sustainable Development, THE SDFs, Paris Agreement and Role of Engineering, Sustainable Development and the Engineering Profession, Key attributes of the Graduate Engineering
Sustainable Engineering Concepts: Key concepts-Factor 4 and Factor 10: Goals of sustainability, System Thinking, Life Cycle Thinking and Circular Economy

Module-2 **08 Hours**

Sustainable Engineering and Concepts, Principles and Frame Work: Green Economy and Low Carbon Economy, Eco Efficiency, Triple bottom Line, Guiding principles of sustainable engineering, Frameworks for sustainable Engineering.
Tools for sustainability Assessment: Environmental Management System, Environmental Auditing, Cleaner Production Assessment, Environmental Impact Assessment, Strategic Environmental

Module-3 **08 Hours**

Fundamentals of Life Cycle Assessment
Why and What is LCA, LCA Goal and Scope, Life cycle inventory, Life Cycle Impact Assessment, Interpretation and presentation of Results, Iterative Nature of LCA, Methodological Choices, LCI Databases and LCA Software's, Strength and Limitations of LCA.

Module-4 **08 Hours**

Environmental Life Cycle Costing, Social Life Cycle Assessment, and Life Cycle Sustainability Assessment: Introduction, Environmental Life Cycle Costing, Social Life Cycle Assessment, Life Cycle Sustainability, LCA Applications in Engineering: Environmental Product Declarations and Product Category Rules, Carbon and Water Foot Printing, Energy systems, Buildings and the Built Environment, Chemical and Chemical Production Food and Agriculture
Introduction to Environmental Economics: Introduction-What Is Environmental Economics?, Valuing the Environment, Market-based Incentives (or Economic Instruments) for Sustainability

Module-5 **08 Hours**

Integrating Sustainability in Engineering Design: Problems Solving in Engineering, conventional to Sustainable Engineering Design Process, Design for Life Guidelines and Strategies, Measuring Sustainability, Sustainable Design through sustainable procurement criteria, Case studies on sustainable Engineering Design Process-Sustainable Process Design, Sustainable Production Design.

Course Outcome:
At the end of the course the student will be able to:

CO1	Elucidate the basics of sustainable development, sustainable engineering.
CO2	Identify the Sustainable Engineering frame work and Assessment tool
CO3	Apply the Principle and methodology of Life Cycle Assessment.
CO4	Demonstrate Environmental, Social Life Cycle Assessment, and Life Cycle Sustainability Assessment
CO5	Out-line the concept of integration methods of sustainability to Engineering Design

Assessment Details

CIE:

	Components	Number	Weight age	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks will be proportionally reduced to 50.
The question paper will have 10 full questions carrying 20 marks each.
There will be 2 full questions (with maximum of four sub questions) from each module.
The students will have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Introduction to Sustainability for Engineers	Toolseeram Ramjeawon	CRC Press	1st Edn., 2020
2	Sustainability Engineering: Concepts, Design and Case studies,	Prentice Hall		1st Edn, 2015
3	System Analysis for sustainable Engineering: Theory and applications, ,	Ni bin Chang	McGraw Hill Publications	1st Edn., 2010
Reference Books				
1	Engineering for Sustainable development: Delivery a sustainable development goals, ,	UNESCO	International Centre for Engineering Education, France,	1st Edn., 2021
2	Introduction to Sustainable Engineering	Rag. R.L. and Ramesh Lakshmi Dinachandran,	PHI Learning Pvt. Ltd.	2nd Edn, 2016

I/II Semester
Course Name: Introduction to Internet of Things (IOT)

Course Code	**22ETC15H/25H**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Pre-requisites:
Basic Computer awareness, input output devices, Basic Electronic components, simple C programming basics etc.

Module-1 **08 Hours**

Basics of Networking: Introduction, Network Types, Layered network models
Emergence of IoT: Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components
(Textbook 1: Chapter 1- 1.1 to 1.3 Chapter 4-4.1 to 4.48)

Module-2 **08 Hours**

Introduction to Transducers: Introduction, Resistive Transducers, Inductive Transducers, Capacitive Transducers, Thermal transducers, Optoelectronic transducer, and Piezoelectric transducers.
IoT Sensing and Actuation: Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics.
(Textbook 1: Chapter 5-5.1 to 5.9)

Module-3 **08 Hours**

IoT Processing Topologies and Types: Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading.
(Textbook 1: Chapter 6-6.1 to 6.5)

Module-4 **08 Hours**

Associated IoT Technologies
Cloud Computing: Introduction, Virtualization, Cloud Models, Service-Level Agreement in Cloud Computing, Cloud Implementation, Sensor-Cloud: Sensors-as-a-Service.
IoT Case Studies
Agricultural IoT-Introduction and Case Studies
(Textbook 1: Chapter 10– 10.1 to 10.6; Chapter 12- 12.1-12.2)

Module-5 **08 Hours**

IoT Case Studies And Future Trends
Vehicular IoT-Introduction
Healthcare IoT-Introduction, Case Studies IoT Analytics-Introduction
(Textbook 1: Chapter 13– 13.1; Chapter 14- 14.1-14.2; Chapter 17- 17.1)

Course Outcomes:
Upon completion of this course, student will be able to:
1. Examine the evolution of IoT, IoT networking components, and addressing strategies in IoT.
2. Characterize the transducers associated with sensors and actuators from the IoT perspective.
3. Identify the importance of processing topologies, design and selection considerations for IoT Devices.
4. Identify the cloud-based associated IoT Technologies.
5. Relate the applications of IoT considering the example case studies in the field of Agriculture, vehicular traffic and healthcare.

Assessment Details

CIE:

	Components	Number	Weight age	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks will be proportionally reduced to 50.
The question paper will have 10 full questions carrying 20 marks each.
There will be 2 full questions (with maximum of four sub questions) from each module.
The students will have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Introduction to IoT	Sudip Misra, Anandarup Mukherjee, Arijit Roy	Cambridge University Press	2021
Reference Books				
1	Introduction to Industrial Internet of Things and Industry 4.0.	S. Misra, C. Roy, and A. Mukherjee	CRC Press	2020
2	Internet of Things (A Hands-on-Approach)	Vijay Madisetti and Arshdeep Bahga	VPT	1st Edition, 2014
3	Rethinking the Internet of Things: A Scalable Approach to Connecting Everything	Francis daCosta	Apress Publications	1st Edition, 2013
Web links and Video Lectures (e-Resources):				
1	https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-cs31/			
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning				
1	Demonstrate a sensor based application			

I/II Semester

Course Name: Waste Management

Course Code:	**22ETC15I/25I**	CIE Marks	50
Course Type (Theory/Practical /Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	3:0:0:0	Exam Hours	3 hrs of Theory
Total Hours of Pedagogy	40 hours	Credits	03

Module-1	**08 Hours**
INTRODUCTION TO SOLID WASTE MANAGEMENT: Classification of solid wastes (source and type based), solid waste management (SWM), elements of SWM, ESSWM (environmentally sound solid waste management) and EST (environmentally sound technologies), factors affecting SWM, Indian scenario, progress in MSW (municipal solid waste) management in India..	
Module-2	**08 Hours**
WASTE GENERATION ASPECTS: Waste stream assessment (WSA), waste generation and composition, waste characteristics (physical and chemical), health and environmental effects (public health and environmental), comparative assessment of waste generation and composition of developing and developed nations, a case study results from an Indian city, handouts on solid waste compositions.	
Module-3	**08 Hours**
COLLECTION, STORAGE, TRANSPORT AND DISPOSAL OF WASTES: Waste Collection, Storage and Transport: Collection components, storage-containers/collection vehicles, collection operation, transfer station, waste collection system design, record keeping, control, inventory and monitoring, implementing collection and transfer system, a case study. Waste Disposal: key issues in waste disposal, disposal options and selection criteria, sanitary landfill, landfill gas emission, leachate formation, environmental effects of landfill, landfill operation issues, a case study.	
Module-4	**08 Hours**
WASTE PROCESSING TECHNIQUES & SOURCE REDUCTION, PRODUCT RECOVERY & RECYCLING: Purpose of processing, mechanical volume and size reduction, component separation, drying and dewatering. Source Reduction, Product Recovery and Recycling: basics, purpose, implementation monitoring and evaluation of source reduction, significance of recycling, planning of a recycling programme, recycling programme elements, commonly recycled materials and processes, a case study.	
Module-5	**08 Hours**
HAZARDOUS WASTE MANAGEMENT AND TREATMENT: Identification and classification of hazardous waste, hazardous waste treatment, pollution prevention and waste minimization, hazardous wastes management in India.	

COURSE OUTCOMES

CO1	Apply the basics of solid waste management towards sustainable development
CO2	Assess the waste generation aspects and its case studies
CO3	Apply technologies to process waste and dispose the same.
CO4	Identify waste processing techniques, source reduction, product recovery and recycling
CO5	Identify and classify hazardous waste and manage the hazard

Assessment Details

CIE:

	Components	Number	Weight age	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B)
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks will be proportionally reduced to 50.
The question paper will have 10 full questions carrying 20 marks each.
There will be 2 full questions (with maximum of four sub questions) from each module.
The students will have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:
Text Books:
1. Tchobaanoglous, G., Theisen, H., and Samuel A Vigil, Integrated Solid Waste Management, McGraw-Hill Publishers, 1993.
2. Bilitewski B., Hard He G., Marek K., Weissbach A., and Boeddicker H., Waste Management, Springer, 1994.

Reference Books:
1. White, F. R., Franke P. R.,, & Hindle M., Integrated solid waste management: a life cycle inventory. McDougall,P. John Wiley & Sons. 2001
2. Nicholas, P., & Cheremisinoff, P. D., Handbook of solid waste management and waste minimization technologies, Imprint of Elsevier Science. 2005

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning
AV presentation by students (on specific topics).
Discussion of case studies based on research findings.
Model making and Poster presentations

I/II Semester
Course Name: Introduction to Cyber Security

Course Code:	**22ETC15J/25J**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	**Theory**	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	**3-0-0-0**	Exam Hours	03
Total Hours of Pedagogy	**40 hours**	Credits	03

Module-1	**8 hours**
Introduction to Cybercrime: Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cybercrimes, An Indian Perspective, Hacking and Indian Laws., Global Perspectives Textbook:1 Chapter 1 (1.1 to 1.5, 1.7-1.9)	
Module-2	**8 hours**
Cyber Offenses: How Criminals Plan Them: Introduction, How criminals plan the attacks, Social Engineering, Cyber Stalking, Cybercaafe & cybercrimes. Botnets: The fuel for cybercrime, Attack Vector. Textbook:1 Chapter 2 (2.1 to 2.7)	
Module-3	**8 hours**
Tools and Methods used in Cybercrime: Introduction, Proxy Servers, Anonymizers, Phishing, Password Cracking, Key Loggers and Spyways, Virus and Worms, Trozen Horses and Backdoors, Steganography, DoS and DDOS Attackes, SQL Injuction, Buffer overflow, Attacks on Wireless networks. Textbook:1 Chapter 4 (4.1 to 4.12)	
Module-4	**8 hours**
Phishing and Identity Theft: Introduction, methods of phishing, phishing, phising techniques, spear phishing, types of phishing scams, phishing toolkits and spy phishing, counter measures, Identity Theft Textbook:1 Chapter 5 (5.1. to 5.3)	
Module-5	**8 hours**
Understnading Computer Forensics: Introdcution, Historical Background of Cyberforensics, Digital Foresics Science, Need for Computer Foresics, Cyber Forensics and Digital Evidence, Digital Forensic Life cycle, Chain of Custody Concepts, network forensics. Approaching a computer forensic Investigation Textbook:1 Chapter 7 (7.1. to 7.5, 7.7 to 7.10)	

Course outcome
At the end of the course the student will be able to:
1 Elucidate the cybercrime terminologies
2 Describe Cyber offenses and Botnets
3 Illustrate Tools and Methods used on Cybercrime
4 Explain Phishing and Identity Theft
5 Identify the need of computer forensics

Assessment Details

CIE:

	Components	Number	Weight age	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B)
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks will be proportionally reduced to 50.

1. The question paper will have 10 full questions carrying 20 marks each.
2. There will be 2 full questions (with maximum of four sub questions) from each module.
3. The students will have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81- 265-21791, 2011, First Edition (Reprinted 2018)

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PROGRAMMONG LANGUAGE COURSES

Semester: I/II
Course Title: Introduction to Web Programming

Course Code:	**22PLC15A/22PLC25A**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:0:2	Exam Hours	03
Total Hours of Pedagogy	40 hours	Credits	03

Module-1 **8 Hours**

Traditional HTML and XHTML:
First Look at HTML and XHTML, Hello HTML and XHTML World, HTML and XHTML: Version History, HTML and XHTML DTDs: The Specifications Up Close, (X)HTML Document Structure, Browsers and (X)HTML, The Rules of (X)HTML, Major Themes of (X)HTML, The Future of Markup□ Two Paths?
TextBook1: Chapter 1

Module-2 **8 Hours**

HTML5:
Hello HTML5, Loose Syntax Returns, XHTML5, HTML5: Embracing the Reality of Web Markup, Presentational Markup Removed and Redefined, HTML5 Document Structure Changes, Adding Semantics, HTML5's Open Media Effort, Client-Side Graphics with □canvas□, HTML5 Form Changes, Emerging Elements and Attributes to Support Web Applications
TextBook1: Chapter 2

Module-3 **8 Hours**

Cascading Style Sheets (CSS)
Introduction, CSS Overview, CSS Rules, Example with Type Selectors and the Universal Selector, CSS Syntax and Style, Class Selectors, ID Selectors, span and div Elements, Cascading, style Attribute, style Container, External CSS Files, CSS Properties, Color Properties, RGB Values for Color, Opacity Values for Color, HSL and HSLA Values for Color, Font Properties, line-height Property, Text Properties, Border Properties, Element Box, padding Property, margin Property, Case Study: Description of a Small City's Core Area.
TextBook2-: Chapter 3

Module-4 **8 Hours**

Tables and CSS, Links and Images
Table Elements, Formatting a Data Table: Borders, Alignment, and Padding, CSS Structural Pseudo- Class Selectors, thead and tbody Elements, Cell Spanning, Web Accessibility, CSS display Property with Table Values, a Element, Relative URLs, Navigation Within a Web Page, CSS for Links, Bitmap Image Formats: GIF, JPEG, PNG, img Element, Responsive Images, Positioning Images, Shortcut Icon, iframe Element.
TextBook2: 5.2 to 5.8, 6.2, 6.3, 6.6., 6.7, 6.9, 6.10, 6.12, 7.2 to 7.4

Module-5 **8 Hours**

Introduction to JavaScript: Functions, DOM, Forms, and Event Handlers
History of JavaScript, Hello World Web Page, Buttons, Functions, Variables, Identifiers, Assignment Statements and Objects, Document Object Model, Forms and How They're Processed: Client-Side Versus Server-Side, form Element, Controls, Text Control, Accessing a Form's Control Values, reset and focus Methods
TextBook2: 8.2 to 8,13, 8.15, 8.16

Programming Assignments:

1. Create an XHTML page using tags to accomplish the following:
   - I. A paragraph containing text "All that glitters is not gold". Bold face and italicize this text
   - II. Create equation: $$x = 1/3(y_1^2 + z_1^2$$
   - III. Put a background image to a page and demonstrate all attributes of background image
   - IV. Create unordered list of 5 fruits and ordered list of 3 flowers
2. Create following table using XHTML tags. Properly align cells, give suitable cell padding and cell spacing, and apply background color, bold and emphasis necessary

	Sem1	SubjectA
		SubjectB
		SubjectC
		SubjectE

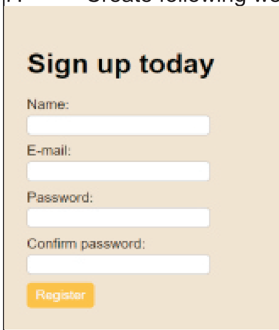
Department	Sem2	SubjectF
		SubjectG
	Sem3	SubjectH
		SubjectI
		SubjectJ

3. Use HTML5 for performing following tasks:
   (i) Draw a square using HTML5 SVG, fill the square with green color and make 6px brown stroke width
   (ii) Write the following mathematical expression by using HTML5 MathML. d=x2-y2
   (iii) Redirecting current page to another page after 5 seconds using HTML5 meta tag
4. Demonstrate the following HTML5 Semantic tags- □article□, □aside□, □details□, □figcaption□,
   □figure□, □footer□, □header□, □main□, □mark□section□ for a webpage that gives information about trave experience.

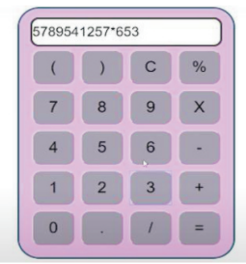
5. Create a class called income, and make it a background color of #0ff. Create a class called expenses, and make it a background color of #f0f. Create a class called profit, and make it a background color of #f00.
   Throughout the document, any text that mentions income, expenses, or profit, attach the appropriate class to that piece of text. Further create following line of text in the same document:
   The current price is 50□and new price is 40□

6. Change the tag li to have the following properties:
   A display status of inline
   A medium, double-lined, black border
   No list style type
   Add the following properties to the style for li:
   Margin of 5px
   Padding of 10px to the top, 20px to the right, 10px to the bottom, and 20px to the left
   Also demonstrate list style type with user defined image logos

7. Create following web page using HTML and CSS with tabular layout



8. Create following calculator interface with HTML and CSS



9. Write a Java Script program that on clicking a button, displays scrolling text which moves from left to right with a small delay

10.	Create a webpage containing 3 overlapping images using HTML, CSS and JS. Further when the mouse is over any image, it should be on the top and fully displayed.

Corse outcomes

1	Elucidate the basic concepts of Python programming language
2	Demonstrate proficiency in handling loops and creation of functions
3	Identify the methods to create and manipulate lists, tuples and dictionaries.
4	Develop programs for string processing and file organization
5	Design and develop Python programs using Object oriented concepts

Assessment Details

CIE for the Theory component: 30 Marks

	Components	Number	Weightage	Max. Marks
1	Tests (A)	3	60%	18
2	Alternate Assessment Tools(AAT) (B)	3	40%	12
	Total Marks for theory component A+B			**30**

CIE for the LAB component: 20 Marks

On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.

The laboratory test (duration 02/03 hours) at the end of the 14th /15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for20 marks.

Final CIE Marks (Maximum) for IC Courses = 30 + 20 = 50

SEE for IC Theory for 3 hours duration

The question paper will have ten questions. Each question is set for 20 marks.

There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)

The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IC, the total marks of all questions should not be more than the 30 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

TextBook-1: HTML & CSS: The Complete Reference Thomas A. Powell,, Fifth Edition, Tata McGraw Hill

TextBook-2: WEB PROGRAMMING with HTML5, CSS and JavaScript, John Dean, Jones & Bartlett Learning, First Edition

Semester: I
Course Title: Introduction to Python Programming

Course Code:	**22PLC15B/25B**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:0:2:0	Exam Hours	03
Total Hours of Pedagogy	40 hours	Credits	03

Module-1 **08 Hours**

Python Basics: Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program, Flow control: Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit(), Functions: def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling, A Short Program: Guess the Number

Textbook 1: Chapters 1 – 3

Module-2 **08 Hours**

Lists: The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples, References,

Dictionaries and Structuring Data: The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things,

Textbook 1: Chapters 4 – 5

Module-3 **08 Hours**

Manipulating Strings: Working with Strings, Useful String Methods, Project: Password Locker, Project: Adding Bullets to Wiki Markup

Reading and Writing Files: Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module, Saving Variables with the print.format() Function, Project: Generating Random Quiz Files, Project: Multiclipboard,

Textbook 1: Chapters 6, 8

Module-4 **08 Hours**

Organizing Files: The shutil Module, Walking a Directory Tree, Compressing Files with the zipfile Module, Project: Renaming Files with American-Style Dates to European-Style Dates, Project: Backing Up a Folder into a ZIP File, Debugging: Raising Exceptions, Getting the Traceback as a String, Assertions, Logging, IDLE□s Debugger.

Textbook 1: Chapters 9-10

Module-5 **08 Hours**

Classes and objects: Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying,

Classes and functions: Time, Pure functions, Modifiers, Prototyping versus planning,

Classes and methods: Object-oriented features, Printing objects, Another example, A more complicated example, The init method, The str method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation,

Textbook 2: Chapters 15 – 17

□□□r□□ □□□□□□□

At the end of the course the student will be able to:

1	Elucidate the basic concepts of Python programming language
2	Demonstrate proficiency in handling loops and creation of functions
3	Identify the methods to create and manipulate lists, tuples and dictionaries.
4	Develop programs for string processing and file organization
5	Design and develop Python programs using Object oriented concepts

Programming Exercises:

1. a. Develop a program to read the student details like Name, USN, and Marks in three subjects. Display the student details, total marks and percentage with suitable messages.
   b. Develop a program to read the name and year of birth of a person. Display whether the person is a senior citizen or not.

2. a. Develop a program to generate Fibonacci sequence of length (N). Read N from the console.
   b. Write a function to calculate factorial of a number. Develop a program to compute binomial coefficient (Given N and R).

3. Read N numbers from the console and create a list. Develop a program to print mean, variance and standard deviation with suitable messages.
4. Read a multi-digit number (as chars) from the console. Develop a program to print the frequency of each digit with suitable message.
5. Develop a program to print 10 most frequently appearing words in a text file. □Hint: Use dictionary with distinct words and their frequency of occurrences. Sort the dictionary in the reverse order of frequency and display dictionary slice of first 10 items□
6. Develop a program to sort the contents of a text file and write the sorted contents into a separate text file. □Hint: Use string methods strip(), len(), list methods sort(), append(), and file methods open(), readlines(), and write()□.
7. Develop a program to backing Up a given Folder (Folder in a current working directory) into a ZIP File by using relevant modules and suitable methods.
8. Write a function named DivExp which takes TWO parameters a, b and returns a value c (c=a/b). Write suitable assertion for a□0 in function DivExp and raise an exception for when b=0. Develop a suitable program which reads two values from the console and calls a function DivExp.
9. Define a function which takes TWO objects representing complex numbers and returns new complex number with a addition of two complex numbers. Define a suitable class □Complex' to represent the complex number. Develop a program to read N (N □=2) complex numbers and to compute the addition of N complex numbers.
10. Develop a program that uses class Student which prompts the user to enter marks in three subjects and calculates total marks, percentage and displays the score card details. □Hint: Use list to store the marks in three subjects and total marks. Use init () method to initialize name, USN and the lists to store marks and total, Use getMarks() method to read marks into the list, and display() method to display the score card details.

COs

	Elucidate the basic concepts of Python programming language
	Demonstrate proficiency in handling loops and creation of functions
	Identify the methods to create and manipulate lists, tuples and dictionaries.
	Develop programs for string processing and file organization
	Design and develop Python programs using Object oriented concepts

Assessment Details

CIE for the Theory component: 30 Marks

	Components	Number	Weightage	Max. Marks
1	Tests (A)	3	60%	18
2	Alternate Assessment Tools(AAT) (B)	3	40%	12
	Total Marks for theory component A+B			**30**

CIE for the LAB component: 20 Marks

On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.

The laboratory test (duration 02/03 hours) at the end of the 14th /15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for20 marks.

Semester: I
Course Title: Basics of Java Programming

Course Code:	**22PLC15C/22PLC25C**	CIE Marks	50
Course Type (Theory/Practical /Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:0:2	Exam Hours	03
Total Hours of Pedagogy	40 hours	Credits	03

Module-1 **8 Hours**

An Overview of Java: Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries, Data Types, Variables, and Arrays: Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, A Few Words About Strings
Text book 1: Ch 2, Ch 3

Module-2 **8 Hours**

Operators: Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses, Control Statements: Java□s Selection Statements, Iteration Statements, Jump Statements.
Text book 1: Ch 4, Ch 5

Module-3 **8 Hours**

Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize( ) Method, A Stack Class, A Closer Look at Methods and Classes: Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion, Introducing Access Control, Understanding static, Introducing final, Arrays Revisited
Text book 1: Ch 6, Ch 7 (7.1-7.□)

Module-4 **8 Hours**

Inheritance: Inheritance, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class.
Text book 1: Ch 8

Module-5 **8 Hours**

Packages and Interfaces: Packages, Access Protection, Importing Packages, Interfaces, Exception Handling: Exception- Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java□s Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions.
Text book 1: Ch □, Ch 10

Programming Assignments

1. Write a JAVA program that prints all real solutions to the quadratic equation ax2+bx+c=0. Read ina, b, c and use the quadratic formula.
2. Write a JAVA program for multiplication of two arrays.
3. Demonstrate the following operations and sign extension with Java programs (i) □□ (ii) □□ (iii) □□□
4. Write a JAVA program to sort list of elements in ascending and descending order
5. Create a JAVA class called Student with the following details as variables within it.
   USN
   NAME
   BRAN CH
   PHON E
   PERCENTAGE
   Write a JAVA program to create n Student objects and print the USN, Name, Branch, Phone, and percentage of these objects with suitable headings.

6. Write a JAVA program demonstrating Method overloading and Constructor overloading.

7. Design a super class called Staff with details as StaffId, Name, Phone, Salary. Extend this class by writing three subclasses namely Teaching (domain, publications), Technical (skills), and Contract (period). Write a JAVA program to read and display at least 3 staff objects of all three categories.
8. Demonstrate dynamic dispatch using abstract class in JAVA.
9. Create two packages P1 and P2. In package P1, create class A, class B inherited from A, class C . In package P2, create class D inherited from class A in package P1 and class E. Demonstrate working of access modifiers (private, public, protected, default) in all these classes using JAVA.
10. Write a JAVA program to read two integers a and b. Compute a/b and print, when b is not zero. Raise an exception when b is equal to zero. Also demonstrate working of ArrayIndexOutOfBoundException.

Course outcome

At the end of the course the student will be able to:

CO1	Elucidate the features and Object Oriented Concepts of JAVA programming.
CO2	Demonstrate the working of various operators in JAVA programming language
CO3	Develop simple programs based on the concept of polymorphism, constructs, operator overloading
CO4	Develop applications using the concepts of Inheritance and method overriding
CO5	Design and develop solutions to solve problems using packages, interfaces and exception handling mechanism

Assessment Details

CIE for the Theory component: 30 Marks

	Components	Number	Weightage	Max. Marks
1	Tests (A)	3	60%	18
2	Alternate Assessment Tools(AAT) (B)	3	40%	12
	Total Marks for theory component A+B			30

CIE for the LAB component: 20 Marks

On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.

The laboratory test (duration 02/03 hours) at the end of the 14th /15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for20 marks.

Final CIE Marks (Maximum) for IC Courses = 30 + 20 = 50

SEE for IC Theory for 3 hours duration

The question paper will have ten questions. Each question is set for 20 marks.

There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)

The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IC, the total marks of all questions should not be more than the 30 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007

Semester: I/II
Course Title: Introduction to C++ Programming

Course Code:	**22PLC15D/22PLC25D**	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:0:2	Exam Hours	03
Total Hours of Pedagogy	40 hours	Credits	03

Module-1 **8 Hours**

Introduction to Object Oriented Programming: Computer programming background- C++ overview. First C++ Program -Basic C++ syntax, Object Oriented Programming: What is an object, Classes, methods and messages, abstraction and encapsulation, inheritance, abstract classes, polymorphism, Difference between POP vs OOP, Application of oops.
Textbook 1: Chapter 1(1.1 to 1.9)

Module-2 **8 Hours**

Functions in C++: Tokens – Keywords – Identifiers and constants – Operators in C++ – Scope resolution operator – Expressions and their types – Special assignment expressions – Function prototyping – Call by reference – Return by reference – Inline functions -Default arguments – Function overloading, Recursive functions.
Textbook 2: Chapter 3(3.2,3.3,3.4,3.13,3.14,3.19, 3.20), chapter 4(4.3,4.4,4.5,4.6,4.7,4.8,4.9)

Module-3 **8 Hours**

Inheritance & Polymorphism: Derived class Constructors, destructors-Types of Inheritance- Defining Derived classes, Single Inheritance, Multiple, Hierarchical Inheritance, Hybrid Inheritance.Problems with multiple Inheritance, Polymorphism:- Static and Dynamic Binding.
Textbook 2: Chapter 6 (6.2,6.11) chapter 8 (8.1 to 8.8)

Module-4 **8 Hours**

I/O Streams: C++ Class Hierarchy- File Stream-Text File Handling- Binary File Handling during fileoperations, Operator over loading.
Textbook 1: Chapter 12(12.5), Chapter 13 (13.6,13.7,13.8)

Module-5 **8 Hours**

Exception Handling: Introduction to Exception - Benefits of Exception handling- Try and catch block Throw statement- Pre-defined exceptions in C++, Namespaces, template and STL library
Textbook 2: Chapter 13 (13.2 to13.6)

Programming Assignments:

1. Write a C++ program to sort the elements in ascending and descending order.
2. Write a C++ program to find the sum of all the natural numbers from 1 to n.
3. Write a C++ program to swap 2 values by writing a function that uses call by reference technique.
4. Write a C++ program to demonstrate function overloading for the following prototypes.
   add(int a, int b)
   add(double a,
   double b)

5. Create a class named Shape with a function that prints "This is a shape". Create another class named Polygon inheriting the Shape class with the same function that prints "Polygon is a shape". Create two other classes named Rectangle and Triangle having the same function which prints "Rectangle is a polygon" and "Triangle is a polygon" respectively. Again, make another class named Square having the same function which prints "Square is a rectangle". Now, try calling the function by the object of each of these classes.
6. Suppose we have three classes Vehicle, FourWheeler, and Car. The class Vehicle is the base class, the class FourWheeler is derived from it and the class Car is derived from the class FourWheeler. Class Vehicle has a method 'vehicle' that prints 'I am a vehicle', class FourWheeler has a method 'fourWheeler' that prints 'I have four wheels', and class Car has a method 'car' that prints 'I am a car'. So, as this is a multi-level inheritance; we can have access to all the other classes methods from the object of the class Car. We invoke all the methods from a Car object and print the corresponding outputs of the methods.

So, if we invoke the methods in this order, car(), fourWheeler(), and vehicle(), then the output will be I am a car
I have four wheels I am a vehicle

Suggested Learning Resources: Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

Textbooks

1. Bhushan Trivedi, “Programming with ANSI C++”, Oxford Press, Second Edition, 2012.
2. Balagurusamy E, Object Oriented Programming with C++, Tata McGraw Hill Education Pvt. Ltd, Fourth Edition 2010.

Course outcome

At the end of the course the student will be able to:

CO1	Design solutions to problems using object-oriented programming concepts.
CO2	Develop applications using function.
CO3	Solve problems using Inheritance and Polymorphism concepts
CO4	Develop programs using the concepts of files.
CO5	Design and Develop Solutions to problems using modular programming constructs.

Assessment Details

CIE for the Theory component: 30 Marks

	Components	Number	Weightage	Max. Marks
1	Tests (A)	3	60%	18
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CIE for the LAB component: 20 Marks

On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments’ write-ups are added and scaled down to 15 marks.

The laboratory test (duration 02/03 hours) at the end of the 14th /15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for20 marks.

Final CIE Marks (Maximum) for IC Courses = 30 + 20 = 50

SEE for IC Theory for 3 hours duration

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The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)

The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IC, the total marks of all questions should not be more than the 30 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50

Final CIE Marks (Maximum) for IC Courses = 30 + 20 = 50
SEE for IC Theory for 3 hours duration

The question paper will have ten questions. Each question is set for 20 marks.

There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)

The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IC, the total marks of all questions should not be more than the 30 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:
Text Books

1. Al Sweigart,"Automate the Boring Stuff with Python",1 stEdition, No Starch Press, 2015. (Available under CC-BY-NC-SA license at https://automatetheboringstuff.com/) (Chapters 1 to 18, except 12) for lambda functions use this link: https://www.learnbyexample.org/python-lambda-function/
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2 nd Edition, Green Tea Press, 2015. (Available under CC-BY-NC license at http://greenteapress.com/thinkpython2/thinkpython2.pdf (Chapters 13, 15, 16, 17, 18) (Download pdf/html files from the above link)

Semester : I

Course Title : ಬಳಕೆ ಕನ್ನಡ **Balake Kannada (Kannada for Usage)**

ಕನ್ನಡ ಕಲಿಕೆಗಾಗಿ ನಿಗದಿಪಡಿಸಿದ ಪಠ್ಯಕ್ರಮ (Prescribed Textbook to Learn Kannada)

Course Code	22KBK17/27	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P:S)	1:0:0:0	Exam Hours	01 Theory
Total Hours	15 hours	Credits	01

Course objectives : ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು

The course (22KBK17/27) will enable the students,

1. To Create the awareness regarding the necessity of learning local language for comfortable and healthy life.
2. To enable learners to Listen and understand the Kannada language properly.
3. To speak, read and write Kannada language as per requirement.
4. To train the learners for correct and polite conservation.
5. To know about Karnataka state and its language, literature and General information about this state.

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ (Teaching-Learning Process - General Instructions) :

These are sample Strategies, which teacher can use to accelerate the attainment of the course outcomes.

1. ಬಳಕೆ ಕನ್ನಡವನ್ನು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಬೋಧಿಸಲು ವಿಟಿಯು ಸೂಚಿಸಿರುವ ಪಠ್ಯ ಪುಸ್ತಕವನ್ನುಉಪಯೋಗಿಸಬೇಕು.

2. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಉತ್ತೇಜಿಸುವುದು ಮತ್ತು ತರಗತಿಗಳಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು.

3. ಪ್ರತಿ ವಿದ್ಯಾರ್ಥಿ ಪುಸ್ತಕವನ್ನುತರಗತಿಯಲ್ಲಿ ಬಳಸುವಂತೆ ನೋಡಿಕೊಳ್ಳುವುದು ಮತ್ತು ಪ್ರತಿ ಪಾಠ ಮತ್ತು ಪ್ರವಚನಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧಪಟ್ಟಂತೆ ಪೂರಕ ಚಟುವಟಿಕೆಗಳಿಗೆ ತೊಡಗಿಸತಕ್ಕದ್ದು.

4. ಡಿಜಿಟಲ್ ತಂತ್ರಜ್ಞಾನದ ಮುಖಾಂತರಇತ್ತೀಚೆಗೆ ಡಿಜಿಟಲೀಕರಣಗೊಂಡಿರುವ ಭಾಷೆಕಲಿಕೆಯ ವಿಧಾನಗಳನ್ನು ಪಿಪಿಟಿ ಮತ್ತುದೃಶ್ಯ ಮಾಧ್ಯಮದ ಮುಖಾಂತರ ಚರ್ಚಿಸಲು ಕ್ರಮಕೈಗೊಳ್ಳುವುದು. ಇದರಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ತರಗತಿಯಲ್ಲಿ ಹೆಚ್ಚು ಏಕಾಗ್ರತೆಯಿಂದ ಪಾಠ ಕೇಳಲು ಮತ್ತುಅಧ್ಯಯನದಲ್ಲಿತೊಡಗಲು ಅನುಕೂಲವಾಗುತ್ತದೆ.

5. ಭಾಷಾಕಲಿಕೆಯ ಪ್ರಯೋಗಾಲಯದ ಮುಖಾಂತರ ಬಹು ಬೇಗ ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಕಲಿಯಲು ಅನುಕೂಲವಾಗುವಂತೆ ಕಾರ್ಯಚಟುವಟಿಕೆಗಳನ್ನು ಮತ್ತು ಕ್ರಿಯಾ ಯೋಜನೆಗಳನ್ನು ರೂಪಿಸುವುದು.

Module-1 **3 hours**

1. Introduction, Necessity of learning a local language. Methods to learn the Kannada language.
2. Easy learning of a Kannada Language: A few tips. Hints for correct and polite conservation, Listening and Speaking Activities, Key to Transcription
3. ವೈಯಕ್ತಿಕ, ಸ್ವಾಮ್ಯಸೂಚಕ/ ಸಂಬಂಧಿತ ಸರ್ವನಾಮಗಳ ಮತ್ತು ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು - Personal Pronouns, Possessive Forms, Interrogative words

Module-2	(3 hours of pedagogy)

1. ನಾಮಪದಗಳ ಸಂಬಂಧಾರ್ಥಕ ರೂಪಗಳು, ಸಂದೇಹಾಸ್ಪದ ಪ್ರಶ್ನೆಗಳು ಮತ್ತು ಸಂಬಂಧವಾಚಕ ನಾಮಪದಗಳು - Possessive forms of nouns, dubitive question and Relative nouns
2. ಗುಣ, ಪರಿಮಾನ ಮತ್ತು ವರ್ಣಬಣ್ಣ ವಿಶೇಷಣಗಳು, ಸಂಖ್ಯಾವಾಚಕಗಳು Qualitative, Quantitative and Colour Adjectives, Numerals
3. ಕಾರಕ ರೂಪಗಳು ಮತ್ತು ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು –ಸಪ್ತಮಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯ–(ಆ, ಅದು, ಅವು, ಅಲ್ಲಿ) - Predictive Forms, Locative Case

Module-3	3 hours

1. ಚತುರ್ಥಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯದ ಬಳಕೆ ಮತ್ತು ಸಂಖ್ಯಾವಾಚಕಗಳು – Dative Cases, and Numerals
2. ಸಂಖ್ಯಾಗುಣವಾಚಕಗಳು ಮತ್ತು ಬಹುವಚನ ನಾಮರೂಪಗಳು – Ordinal numerals and Plural markers
3. ನ್ಯೂನ/ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾಪದಗಳು & ವರ್ಣ ಗುಣವಾಚಕಗಳು – Defective/Negative Verbs & Colour Adjectives

Module-4	3 hours

1. ಅಪ್ಪಣೆ / ಒಪ್ಪಿಗೆ, ನಿರ್ದೇಶನ, ಪ್ರೋತ್ಸಾಹ ಮತ್ತು ಒತ್ತಾಯ ಅರ್ಥರೂಪ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು - Permission, Commands, encouraging and Urging words (Imperative words and sentences)
2. ಸಾಮಾನ್ಯ ಸಂಭಾಣೆಗಳಲ್ಲಿ ದ್ವಿತೀಯ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ಸಂಭವನೀಯ ಪ್ರಕಾರಗಳು Accusative Cases and Potential Forms used in General Communication
3. "ಇರು ಮತ್ತು ಇರಲ್ಲ" ಸಹಾಯಕ ಕ್ರಿಯಾಪದಗಳು, ಸಂಭಾವ್ಯಸೂಚಕ ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಪದಗಳ ಬಳಕೆ - Helping Verbs "iru and iralla", Corresponding Future and Negation Verbs.
4. ಹೋಲಿಕೆ (ತಾರತಮ್ಯ), ಸಂಬಂಧ ಸೂಚಕ, ವಸ್ತು ಸೂಚಕ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಪದಗಳ ಬಳಕೆ – Comparative, Relationship, Identification and Negation Words

Module-5	3 hours

1. ಕಾಲ ಮತ್ತು ಸಮಯದ ಹಾಗೂ ಕ್ರಿಯಾಪದಗಳ ವಿವಿಧ ಪ್ರಕಾರಗಳು - Different types of Tense, Time and Verbs
2. ದ್, –ತ್, –ತು, –ಇತು, –ಆಗಿ, –ಅಲ್ಲ, –ಗ್, –ಕ್, ಇದೆ, ಕ್ರಿಯಾ ಪ್ರತ್ಯಯಗಳೊಂದಿಗೆ ಭೂತ, ಭವಿಷ್ಯತ್ ಮತ್ತು ವರ್ತಮಾನ ಕಾಲ ವಾಕ್ಯರಚನೆ- Formation of Past, Future and Present Tense Sentences with Verb Forms
3. Kannada Vocabulary List : ಸಂಭಾಷಣೆಯಲ್ಲಿ ದಿನೋಪಯೋಗಿಕನ್ನಡ ಪದಗಳು -Kannada Words in Conversation

Course outcome (Course Skill Set)
ಕನ್ನಡ ಬಳಕೆ ಪಠ್ಯ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವ ಅನುಕೂಲಗಳು ಮತ್ತು ಫಲಿತಾಂಶಗಳು
At the end of the course the student will be able to:

CO1	To understand the necessity of learning of local language for comfortable life.
CO2	To speak, read and write Kannada language as per requirement.
CO3	To communicate (converse) in Kannada language in their daily life with Kannada speakers.
CO4	To Listen and understand the Kannada language properly.
CO5	To speak in polite conservation.

Assessment Details

Continuous Internal Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B) = 30 + 20 = 50

Semester End Examination (SEE)
Question paper pattern:
SEE paper will be set for 50 questions of each of 01 marks. The pattern of the question paper is MCQ. The time allotted for SEE is 01 hour.

University Prescribed Text Book:

ಬಳಕೆ ಕನ್ನಡ

ಡಾ.ಎಲ್.ತಿಮ್ಮೇಶ

ಪ್ರಕಟಣೆ: ಪ್ರಸಾರಂಗ
ವಿಶ್ವೇಶ್ವರಯ್ಯತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ

Semester: I/II

Course Title: ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ

ಕನ್ನಡ ಬಲ್ಲ ಮತ್ತು ಕನ್ನಡ ಮಾತೃ ಭಾಷೆಯ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ನಿಗದಿಪಡಿಸಿದ ಪಠ್ಯಕ್ರಮ

Course Code	22KSK17/27	CIE Marks	50
Course Type (Theory / Practical / Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P:S)	1:0:0:0	Exam Hours	01 Theory
Total Hours	15 hours	Credits	01

Course objectives : **ಸಾಂಸ್ಕೃತಿಕಕನ್ನಡ ಪಠ್ಯಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು**

- The course (22KSK17/27) will enable the students,
- 1. ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ, ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
- 2. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಪ್ರಧಾನ ಭಾಗವಾದಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತುಆಧುನಿಕ ಕಾವ್ಯಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
- 3. ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಅರಿವು ಹಾಗೂ ಆಸಕ್ತಿಯನ್ನು ಮೂಡಿಸುವುದು.
- 4. ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವನ್ನು ಹಾಗೂ ಅವರು ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
- 5. ಸಾಂಸ್ಕೃತಿಕಜನಪದ ಹಾಗೂ ಪ್ರವಾಸ ಕಥನಗಳ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ (Teaching-Learning Process - General Instructions) :

These are sample Strategies, which teacher can use to accelerate the attainment of the course outcomes.

1. ಸಾಂಸ್ಕೃತಿಕಕನ್ನಡವನ್ನು ಬೋಧಿಸಲುತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಪ್ರಸ್ತುತ ಪುಸ್ತಕ ಆಧಾರಿಸಿ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನವನ್ನುಅನುಸರಿಸುವುದು. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಪ್ರೇರೇಪಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು.

2. ಇತ್ತೀಚಿನತಂತ್ರಜ್ಞಾನದ ಅನುಕೂಲಗಳನ್ನು ಬಳಸಿಕೊಳ್ಳುವುದು. ಅಂದರೆ ಕವಿ–ಕಾವ್ಯ ಪರಿಚಯದಲ್ಲಿ ಕವಿಗಳ ಚಿತ್ರಣ ಮತ್ತು ಲೇಖನಗಳು ಮತ್ತು ಕಥೆಕಾವ್ಯಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧಪಟ್ಟ ಧ್ವನಿ ಚಿತ್ರಗಳು, ಸಂಭಾಷಣೆಗಳು, ಈಗಾಗಲೇ ಇತರ ವಿಮರ್ಶಕರು ಬರೆದಿರುವ ವಿಮರ್ಶಾತ್ಮಕ ವಿಷಯಗಳನ್ನು ಟಿಪಿಟಿ, ಡಿಜಿಟಲ್ ಮಾಧ್ಯಮಗಳ ಮುಖಾಂತರ ವಿಶ್ಲೇಷಿಸುವುದು.

3. ನವೀನ ಮಾದರಿಯ ಸಾಹಿತ್ಯ ಬೋಧನೆಗೆ ಸಂಬಂಧಪಟ್ಟ ವಿಧಾನಗಳನ್ನು ಶಿಕ್ಷಕರು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಅನುಕೂಲವಾಗುವ ರೀತಿಯಲ್ಲಿ ಅಳವಡಿಸಿಕೊಳ್ಳಬಹುದು.

ಘಟಕ–1 ಕನ್ನಡ ಸಂಸ್ಕೃತಿ ಮತ್ತು ಭಾಷೆಕುರಿತಾದ ಲೇಖನಗಳು (03 hours of pedagogy)

1. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ – ಹಂಪ ನಾಗರಾಜಯ್ಯ
2. ಕರ್ನಾಟಕದಏಕೀಕರಣ : ಒಚಿದು ಅಪೂರ್ವಚರಿತ್ರೆ– ಜಿ ವೆಂಕಟ ಸುಬ್ಬಯ್ಯ
3. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ – ಡಾ.ಎಲ್ತಿಮ್ಮೆಶ ಮತ್ತು ಪ್ರೊಫೆಸರ್ ವಿ ಕೇಶವಮೂರ್ತಿ

ಘಟಕ–2 ಆಧುನಿಕ ಪೂರ್ವದಕಾವ್ಯ ಭಾಗ (03 hours of pedagogy)

1. ವಚನಗಳು : ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಆಯ್ದಕ್ಕಿ ಮಾರಯ್ಯ, ಜೇಡರ ದಾಸಿಮಯ್ಯ,ಆಯ್ದಕ್ಕಿ ಲಕ್ಕಮ್ಮ
2. ಕೀರ್ತನೆಗಳು: ಅದರಿಂದ ಏನು ಫಲ ಇದರಿಂದ ಏನು ಫಲ – ಪುರಂದರದಾಸರು ತಲ್ಲಣಿಸದಿರುಕಂಡ್ಯ ತಾಳು ಮನವೇ ಕನಕದಾಸರು
3. ತತ್ವಪದಗಳು: ಸಾವಿರ ಕೊಡಗಳ ಸುಟ್ಟು – ಶಿಶುನಾಳ ಶರೀಫ

ಘಟಕ–3 ಆಧುನಿಕಕಾವ್ಯ ಭಾಗ	3 hours
1. ಡಿವಿಜಿಅವರ ಮಂಕುತಿಮ್ಮನಕಗ್ಗದಿಂದಆಯ್ದ ಕೆಲವು ಭಾಗಗಳು 2. ಕುರುಡುಕಾಂಚಾಣ:ದಾ.ರಾ. ಬೇಂದ್ರೆ 3. ಹೊಸ ಬಾಳಿನ ಗೀತೆ: ಕುವೆಂಪು	
ಘಟಕ–4 ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ	3 hours
1. ಡಾ. ಸರ್ ಎಂ ವಿಶ್ವೇಶ್ವರಯ್ಯ ವ್ಯಕ್ತಿ ಮತ್ತುಐತಿಹ್ಯ– ಎ.ಎನ್. ಮೂರ್ತಿರಾವ್ 2. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ –ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ	
ಘಟಕ–5 ಸಾಂಸ್ಕೃತಿಕಜನಪದಕಥೆ ಮತ್ತು ಪ್ರವಾಸಕಥನ	3 hours
1. ಯುಗಾದಿ : ವಸುಧೇಂದ್ರ 2. ಮೇಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ: ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯ	

Course outcome (Course Skill Set) ಸಾಂಸ್ಕೃತಿಕಕನ್ನಡ(22KSK17/27) ಪಠ್ಯಕಲಿಕೆಯ ನಂತರ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ At the end of the course the student will be able to:	
CO1	ಕನ್ನಡ ಭಾಷೆ ಸಾಹಿತ್ಯ ಮತ್ತುಕನ್ನಡದ ಸಂಸ್ಕೃತಿಕುರಿತುಅರಿವು ಮೂಡಿರುತ್ತದೆ.
CO2	ಕನ್ನಡ ಸಾಹಿತ್ಯದಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳನ್ನು ಸಾಂಕೇತಿಕವಾಗಿಕಲಿತು ಹೆಚ್ಚಿನ ಓದಿಗೆ ಮತ್ತುಜ್ಞಾನಕ್ಕೆ ಸ್ಫೂರ್ತಿ ಮೂಡುತ್ತದೆ.
CO3	ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಅರಿವು ಹಾಗೂ ಆಸಕ್ತಿ ಹೆಚ್ಚಾಗುತ್ತದೆ.
CO4	ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ ಹಾಗೂ ಅವರುಗಳ ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ತಿಳಿದುಕೊಂಡು ನಾಡಿನಇನ್ನಿತರ ವ್ಯಕ್ತಿಗಳ ಬಗ್ಗೆ ತಿಳಿದುಕೊಳ್ಳಲು ಕೌತುಕತೆ ಹೆಚ್ಚಾಗುತ್ತದೆ.
CO5	ಸಾಂಸ್ಕೃತಿಕಜನಪದ ಹಾಗೂ ಪ್ರವಾಸ ಕಥನಗಳ ಪರಿಚಯಆಗುವುದು.

Assessment Details

Continuous Internal Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B) = 30 + 20 = 50

Semester End Examination (SEE)
Question paper pattern:
SEE paper will be set for 50 questions of each of 01 marks. The pattern of the question paper is MCQ. The time allotted for SEE is 01 hour

University Prescribed Text Book:

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ
ಡಾ. ಹಿ.ಚಿ. ಬೋರಲಿಂಗಯ್ಯ ಮತ್ತುಡಾ.ಎಲ್.ತಿಮ್ಮೇಶ

ಪ್ರಕಟಣೆ: ಪ್ರಸಾರಂಗ
ವಿಶ್ವೇಶ್ವರಯ್ಯತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ

VISVESVARAYA TECHNOLOGICAL UNIVERSITY
BELAGAVI

Scheme of Teaching and Examination and Syllabus
B.E. CIVIL ENGINEERING
(Effective from Academic year 2018-19)

General Notes:

1. Question Paper Pattern for Theory Courses:
   - The question paper will have TEN questions, Each full question carries 20 marks, There will be two full questions (with a maximum of four subquestions) from each module.Each full question will have sub questions covering all the topicsunder a module.
   - Students will have to answer 5 full questions, selecting one fullquestion from each module.
2. The teaching learning process should be as per the Choice Based CreditSystem
3. All Civil Engineering Departments should have a “CIVIL ENGINEERINGMUSEUM” with collections like models,charts, material samples, fixtures and fittings etc. which assist effectiveteaching learning process.
4. The teaching learning process may be planned to develop capabilities,competencies and skills required for career development based on coursebeginning and course end surveys.
5. Course objectives, course outcomes and RBT levels given under eachcourse in the syllabus are indicative/suggestive. The facultycan set them appropriately according to their lesson/ course plan.
6. The course coordinators/teachers/instructors are informed to deliberatein the faculty meeting with module coordinator, program coordinatoralong with the stake holders to develop the respective lesson/ courseplans.
7. The department advisory board may make suitable changes to thecourse objectives, course outcomes according totheir finalized course plans.
8. The faculty should complement the teaching with case studies and fieldvisits wherever required.
9. At least one faculty development program to be conducted to complimentteaching learning process by the department in a year

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

Scheme of Teaching and Examination 2018 – 19

Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2018 – 19)

Programme: CIVIL ENGINEERING

III SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	BSC	18MAT31	Transform Calculus, Fourier Series and Numerical Techniques	Mathematics	2	2	--	03	40	60	100	3
2	PCC	18CV32	Strength of Materials	Civil Engg.	3	2	--	03	40	60	100	4
3	PCC	18CV33	Fluid Mechanics	Civil Engg.	3	0	--	03	40	60	100	3
4	PCC	18CV34	Building Materials and Construction	Civil Engg.	3	0	--	03	40	60	100	3
5	PCC	18CV35	Basic Surveying	Civil Engg.	3	0	--	03	40	60	100	3
6	PCC	18CV36	Engineering Geology	Geology	3	0	--	03	40	60	100	3
7	PCC	18CVL37	Computer Aided Building Planning & Drawing	Civil Engg.	--	2	2	03	40	60	100	2
8	PCC	18CVL38	Building Materials Testing Laboratory	Civil Engg.	--	2	2	03	40	60	100	2
9	HSMC	18KVK39	Vyavaharika Kannada (Kannada for communication)/	HSMC	--	2	--	--	100	--	100	1
			OR									
		18KAK39	Aadalitha Kannada (Kannada for Administration)									
			OR									
		18CPC39	Constitution of India, Professional Ethics and Cyber Law		1	--	--	02	40	60		
					Examination is by objective type questions							
				TOTAL	**17 OR 18**	**08 OR 10**	**04**	**24 OR 26**	**420 OR 360**	**480 OR 540**	**900**	**24**

Note: BSC: Basic Science, PCC: Professional Core, HSMC: Humanity and Social Science, NCMC: Non-credit mandatory course.

18KVK39Vyavaharika Kannada (Kannada for communication) is for non-Kannada speaking, reading and writing students and 18KAK39 Aadalitha Kannada (Kannada for Administration) is for students who speak, read and write Kannada.

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

10	NCMC	18MATDIP31	Additional Mathematics - I	Mathematics	02	01	--	03	40	60	100	0

(a)The mandatory non – credit courses Additional Mathematics I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE/B. Tech programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the University examination. In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured F

grade. In such a case, the students have to fulfill the requirements during subsequent semester/s to appear for SEE.
(b)These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

Courses prescribed to lateral entry B. Sc degree holders admitted to III semester of Engineering programs

Lateral entrant students from B.Sc. Stream, shall clear the non-credit courses Engineering Graphics and Elements of Civil Engineering and Mechanics of the First Year Engineering Programme. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

AICTE Activity Points to be earned by students admitted to BE/B. Tech/B. Plan day college programme (For more details refer to Chapter 6,AICTE Activity Point Programme, Model Internship Guidelines):

Over and above the academic grades, every Day College regular student admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Programme. Students transferred from other Universities to fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card.

The activities can be can be spread over the years, anytime during the semester weekends and holidays, as per the liking and convenience of the student from the year of entry to the programme. However, minimum hours' requirement should be fulfilled. Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.

In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2018 – 19
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2018 – 19)

Programme: CIVIL ENGINEERING

IV SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week: Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	BSC	18MAT41	Complex Analysis, Probability And Statistical Methods	Mathematics	2	2	--	03	40	60	100	3
2	PCC	18CV42	Analysis of Determinate Structures	Civil Engg.	3	2	--	03	40	60	100	4
3	PCC	18CV43	Applied Hydraulics	Civil Engg.	3	0	--	03	40	60	100	3
4	PCC	18CV44	Concrete Technology	Civil Engg.	3	0	--	03	40	60	100	3
5	PCC	18CV45	Advanced Surveying	Civil Engg.	3	0	--	03	40	60	100	3
6	PCC	18CV46	Water Supply & Treatment Engineering	Civil Engg.	3	0	--	03	40	60	100	3
7	PCC	18CVL47	Engineering Geology Laboratory	Geology	--	2	2	03	40	60	100	2
8	PCC	18CVL48	Fluid Mechanics and Hydraulic Machines Laboratory	Civil Engg.	--	2	2	03	40	60	100	2
9	HSMC	18KVK39/49	Vyavaharika Kannada (Kannada for Communication)/	HSMC	--	2	--	--	100	--	100	1
		OR										
		18KAK39/49	Aadalitha Kannada (Kannada for Administration)									
		OR										
		18CPC39/49	Constitution of India, Professional Ethics and Cyber Law		1	--	--	02	40	60		
					Examination is by objective type questions							
				TOTAL	**17 OR 18**	**08 OR 10**	**04**	**24 OR 26**	**420 OR 360**	**480 OR 540**	**900**	**24**

Note: BSC: Basic Science, PCC: Professional Core, HSMC: Humanity and Social Science, NCMC: Non-credit mandatory course.

18KVK39/49Vyavaharika Kannada (Kannada for communication) is for non-Kannada speaking, reading and writing students and 18KAK39/49Aadalitha Kannada (Kannada for Administration) is for students who speak, read and write Kannada.

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

10	NCMC	18MATDIP41	Additional Mathematics - II	Mathematics	02	01	--	03	40	60	100	0

(a)The mandatory non – credit courses Additional Mathematics I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE/B. Tech programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the University examination. In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured F grade. In such a case, the students have to fulfill the requirements during subsequent semester/s to appear for SEE.

(b)These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.
Courses prescribed to lateral entry B. Sc degree holders admitted to III semester of Engineering programs
Lateral entrant students from B.Sc. Stream, shall clear the non-credit courses Engineering Graphics and Elements of Civil Engineering and Mechanics of the First Year Engineering Programme. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.
AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2018 – 19
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2018 – 19)

Programme: CIVIL ENGINEERING

V SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	HSMC	18CV51	Construction Management & Entrepreneurship	Civil Engg.	2	2	--	03	40	60	100	3
2	PCC	18CV52	Analysis of Indeterminate Structures	Civil Engg.	3	2	--	03	40	60	100	4
3	PCC	18CV53	Design of RC Structural Elements	Civil Engg.	3	2	--	03	40	60	100	4
4	PCC	18CV54	Basic Geotechnical Engineering	Civil Engg.	3	--	--	03	40	60	100	3
5	PCC	18CV55	Municipal Wastewater Engineering	Civil Engg.	3	--	--	03	40	60	100	3
6	PCC	18CV56	Highway Engineering	Civil Engg.	3	--	--	03	40	60	100	3
7	PCC	18CVL57	Surveying Practice	Civil Engg.	--	2	2	03	40	60	100	2
8	PCC	18CVL58	Concrete and Highway Materials Laboratory	Civil Engg.	--	2	2	03	40	60	100	2
9	HSMC	18CIV59	Environmental Studies	Civil/Environmental [Paper setting Board: Civil Engineering]	1	--	--	02	40	60	100	1
				TOTAL	**18**	**10**	**04**	**26**	**360**	**540**	**900**	**25**

Note: PCC: Professional Core, HSMC: Humanity and Social Science.

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

CIVIL ENGINEERING

Scheme of Teaching and Examination 2018 – 19

Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2018 – 19)

VI SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	18CV61	Design of Steel Structural Elements	Civil Engg.	3	2	--	03	40	60	100	4
2	PCC	18CV62	Applied Geotechnical Engineering	Civil Engg.	3	2	--	03	40	60	100	4
3	PCC	18CV63	Hydrology and Irrigation Engineering	Civil Engg.	3	2	--	03	40	60	100	4
4	PEC	18CV64X	Professional Elective -1	Civil Engg.	3	--	--	03	40	60	100	3
5	OEC	18CV65X	Open Elective -A	Civil Engg.	3	--	--	03	40	60	100	3
6	PCC	18CVL66	Software Application Laboratory	Civil Engg.	--	2	2	03	40	60	100	2
7	PCC	18CVL67	Environmental Engineering Laboratory	Civil Engg.	--	2	2	03	40	60	100	2
8	EP	18CVEP68	Extensive Survey project	Civil Engg.	--	2	2	03	40	60	100	2
9	Internship	--	Internship	To be carried out during the vacation/s of VI and VII semesters and /or VII and VIII semesters.								
				TOTAL	**15**	**12**	**06**	**24**	**320**	**480**	**800**	**24**

Note: PCC: Professional core, PEC: Professional Elective, OE: Open Elective, MP: Mini-project.

Professional Elective -1

Course code under18CV64X	
18CV641	Matrix Method of Structural Analysis

18CV642	Solid Waste Management
18CV643	Alternate Building Materials
18CV644	Ground Improvement Techniques
18CV645	Railway, Harbours, Tunnelling & Airports
Open Elective -A	
Course code under18CV65X	
18CV651	Remote Sensing & GIS
18CV652	Traffic Engineering
18CV653	Occupational Health & Safety
18CV654	Sustainability Concepts in Civil Engineering
18CV655	**Intelligent Transportation Systems**
18CV656	**Conservation of Natural Resources**

Students can select any one of the open electives offered by other Departments expect those that are offered by the parent Department (Please refer to the list of open electives under 18XX65X).

Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

Internship: All the students admitted to III year of BE/B. Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements.

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2018 – 19
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2018 – 19)

Programme: CIVIL ENGINEERING

VII SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	18CV71	Quality Surveying and Contract Management	Civil Engg.	3	--	--	03	40	60	100	3
2	PCC	18CV72	Design of RCC and Steel Structures	Civil Engg.	3	--	--	03	40	60	100	3
3	PEC	18CV73X	Professional Elective - 2	Civil Engg.	3	--	--	03	40	60	100	3
4	PEC	18CV74X	Professional Elective - 3	Civil Engg.	3	--	--	03	40	60	100	3
5	OEC	18CV75X	Open Elective -B	Civil Engg.	3	--	--	03	40	60	100	3
6	PCC	18CVL76	Computer Aided Detailing of Structures	Civil Engg.	--	2	2	03	40	60	100	2
7	PCC	18CVL77	Geotechnical Engineering Laboratory	Civil Engg.	--	2	2	03	40	60	100	2
8	Project	18CVP78	Project Work Phase - 1		--	--	2	--	100	--	100	1
9	Internship	--	Internship	(If not completed during the vacation of VI and VII semesters, it shall be carried out during the vacation of VII and VIII semesters)								
				TOTAL	**15**	**04**	**06**	**21**	**380**	**420**	**00**	**20**

Note: PCC: Professional core, PEC: Professional Elective.

Professional Elective - 2

Course code under 18CV73X	**Course Title**
18CV731	Theory of Elasticity
18CV732	Air Pollution and Control
18CV733	Pavement Materials & Construction
18CV734	Ground Water Hydraulics
18CV735	Masonry Structures

Professional Electives - 3

Course code under 18CV74X	**Course Title**
18CV741	Earthquake Engineering
18CV742	Design Concepts of Building Services
18CV743	Reinforced Earth Structures

18CV744	Design of Hydraulic Structures
18CV745	Urban Transport Planning
Open Elective -B	
Course code under 18CV75X	**Course Title**
18CV751	Finite Element Method
18CV752	Numerical Methods and Applications
18CV753	Environmental Protection and Management

Students can select any one of the open electives offered by other Departments expect those that are offered by the parent Department (Please refer to the list of open electives under 18XX75X).

Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

Project work:

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary project can be assigned to an individual student or to a group having not more than 4 students. In extraordinary cases, like the funded projects requiring students from different disciplines, the project student strength can be 5 or 6.

CIE procedure for Project Work Phase - 1:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work phase -1, shall be based on the evaluation of the project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the Project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable.

The CIE marks awarded for the project work phase -1, shall be based on the evaluation of project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

Internship: All the students admitted to III year of BE/B. Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements.

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2018 – 19
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2018 – 19)

Programme: CIVIL ENGINEERING

VIII SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
					L	T	P					
1	PCC	18CV81	Design of Pre-stressed Concrete	Civil Engg.	3	--	--	03	40	60	100	3
2	PEC	18CV82X	Professional Elective - 4	Civil Engg.	3	--	--	03	40	60	100	3
3	Project	18CVP83	Project Work Phase - 2	Civil Engg.	--	--	16	03	40	60	100	8
4	Seminar	18CVS84	Technical Seminar	Civil Engg.	--	--	2	03	100	--	100	1
5	Internship	18CVI85	Internship	Completed during the vacation/s of VI and VII semesters and /or VII and VIII semesters.)				03	40	60	100	3
				TOTAL	**06**	**--**	**18**	**15**	**260**	**240**	**500**	**18**

Note: PCC: Professional Core, PEC: Professional Elective.

Professional Electives - 4

Course code under 18CV82X	Course Title
18CV821	Bridge Engineering
18CV822	Prefabricated Structures
18CV823	Advanced Foundation Engineering
18CV824	Rehabilitation & Retrofitting
18CV825	Pavement Design

Project Work

CIE procedure for Project Work Phase - 2:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

SEE for Project Work Phase - 2:

(i) Single discipline: Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted at the department. **(ii) Interdisciplinary:** Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belongs to. **Internship:** Those, who have not pursued /completed the internship, shall be declared as fail and have to complete during subsequent University examination after satisfying the internship requirements.
AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card. Activity points of the students who have earned the prescribed AICTE activity Points shall be sent the University along with the CIE marks of 8th semester. In case of students who have not satisfied the AICTE activity Points at the end of eighth semester, the column under activity Points shall be marked NSAP (Not Satisfied Activity Points).

B.E.(Common to all Programmes)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER - III

TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES
(Common to all Programmes)

Course Code	**18MAT31**	CIE Marks	40
Teaching Hours/Week (L: T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To have an insight into Fourier series, Fourier transforms, Laplace transforms, Difference equations and Z-transforms.
- To develop the proficiency in variational calculus and solving ODE's arising in engineering applications, using numerical methods.

Module-1

Laplace Transform: Definition and Laplace transforms of elementary functions (statements only). Laplace transforms of Periodic functions (statement only) and unit-step function – problems.
Inverse Laplace Transform: Definition and problem s, Convolution theorem to find the inverse Laplace transforms (without Proof) and problems. Solution of linear differential equations using Laplace transforms.

Module-2

Fourier Series: Periodic functions, Dirichlet's condition. Fourier series of periodic functions period 2π and arbitrary period. Half range Fourier series. Practical harmonic analysis.

Module-3

Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transforms. Problems.
Difference Equations and Z-Transforms: Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping and shifting rules, initial value and final value theorems (without proof) and problems, Inverse z-transform and applications to solve difference equations.

Module-4

Numerical Solutions of Ordinary Differential Equations(ODE's):
Numerical solution of ODE's of first order and first degree- Taylor's series method, Modified Euler's method. Runge - Kutta method of fourth order, Milne's and Adam-Bash forth predictor and corrector method (No derivations of formulae)-Problems.

Module-5

Numerical Solution of Second Order ODE's: Runge-Kutta method and Milne's predictor and corrector method. (No derivations of formulae).
Calculus of Variations: Variation of function and functional, variational problems, Euler's equation, Geodesics, hanging chain, problems.

Course outcomes: At the end of the course the student will be able to:

- CO1: Use Laplace transform and inverse Laplace transform in solving differential/ integral equation arising in network analysis, control systems and other fields of engineering.
- CO2: Demonstrate Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
- CO3: Make use of Fourier transform and Z-transform to illustrate discrete/continuous function arising in wave and heat propagation, signals and systems.
- CO4: Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.
- CO5:Determine the externals of functional using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10^{th} Edition, 2016
2	Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers	44^{th} Edition, 2017
3	Engineering Mathematics	Srimanta Pal et al	Oxford University Press	3^{rd} Edition, 2016
Reference Books				
1	Advanced Engineering Mathematics	C. Ray Wylie, Louis C. Barrett	McGraw-Hill Book Co	6^{th} Edition, 1995
2	Introductory Methods of Numerical Analysis	S. S. Sastry	Prentice Hall of India	4^{th} Edition 2010
3	Higher Engineering Mathematics	B.V. Ramana	McGraw-Hill	11^{th} Edition,2010
4	A Textbook of Engineering Mathematics	N. P. Bali and Manish Goyal	Laxmi Publications	6^{th} Edition, 2014
5	Advanced Engineering Mathematics	Chandrika Prasad and Reena Garg	Khanna Publishing,	2018

Web links and Video Lectures:

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU EDUSAT PROGRAMME - 20

B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - III			
STRENGTH OF MATERIALS			
Course Code	**18CV32**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives: This course will enable students

1. To understand the basic concepts of the stresses and strains for different materials and strength of structural elements.
2. To know the development of internal forces and resistance mechanism for one dimensional and two-dimensional structural elements.
3. To analyse and understand different internal forces and stresses induced due to representative loads on structural elements.
4. To determine slope and deflections of beams.
5. To evaluate the behaviour of torsion members, columns and struts.

Module-1

Simple Stresses and Strain: Introduction, Definition and concept and of stress and strain. Hooke's law, Stress-Strain diagrams for ferrous and non-ferrous materials, factor of safety, Elongation of tapering bars of circular and rectangular cross sections, Elongation due to self-weight. Saint Venant's principle, Compound bars, Temperature stresses, Compound section subjected to temperature stresses, state of simple shear, Elastic constants and their relationship.

Module-2

Compound Stresses: Introduction, state of stress at a point, General two dimensional stress system, Principal stresses and principal planes. Mohr's circle of stresses**.** Theory of failures: Max. Shear stress theory and Max. principal stress theory.

Thin and Thick Cylinders: Introduction, Thin cylinders subjected to internal pressure; Hoop stresses, Longitudinal stress and change in volume. Thick cylinders subjected to both internal and external pressure; Lame's equation, radial and hoop stress distribution.

Module-3

Shear Force and Bending Moment in Beams: Introduction to types of beams, supports and loadings. Definition of bending moment and shear force, Sign conventions, relationship between load intensity, bending moment and shear force. Shear force and bending moment diagrams for statically determinate beams subjected to points load, uniformly distributed loads, uniformly varying loads, couple and their combinations.

Module-4

Bending and Shear Stresses in Beams: Introduction, pure bending theory, Assumptions, derivation of bending equation, modulus of rupture, section modulus, flexural rigidity. Expression for transverse shear stress in beams, Bending and shear stress distribution diagrams for circular, rectangular, 'I', and 'T' sections. Shear centre (only concept).

Torsion in Circular Shaft: Introduction, pure torsion, Assumptions, derivation of torsion equation for circular shafts, torsional rigidity and polar modulus Power transmitted by a shaft.

Module-5

Deflection of Beams: Definition of slope, Deflection and curvature, Sign conventions, Derivation of moment-curvature equation. Double integration method and Macaulay's method: Slope and deflection for standard loading cases and for determinate prismatic beams subjected to point loads, UDL, UVL and couple.

Columns and Struts: Introduction, short and long columns. Euler's theory; Assumptions, Derivation for Euler's Buckling load for different end conditions, Limitations of Euler's theory. Rankine-Gordon's formula for columns.

Course outcomes: After studying this course, students will be able;

1. To evaluate the basic concepts of the stresses and strains for different materials and strength of structural elements.
2. To evaluate the development of internal forces and resistance mechanism for one dimensional and two dimensional structural elements.
3. To analyse different internal forces and stresses induced due to representative loads on structural elements.
4. To evaluate slope and deflections of beams.
5. To evaluate the behaviour of torsion members, columns and struts.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. B.S. Basavarajaiah, P. Mahadevappa "Strength of Materials" in SI Units, University Press (India) Pvt. Ltd., 3rd Edition,2010
2. Ferdinand P. Beer, E. Russell Johnston and Jr. John T. De Wolf "Mechanics of Materials", Tata McGraw-Hill, Third Edition, SI Units

Reference Books:

1. D.H. Young, S.P. Timoshenko "Elements of Strength of Materials" East West Press Pvt. Ltd., 5th Edition (Reprint2014).
2. R K Bansal, "A Textbook of Strength of Materials", 4th Edition, Laxmi Publications, 2010.
3. S.S. Rattan "Strength of Materials" McGraw Hill Education (India) Pvt. Ltd., 2nd Edition (Sixth reprint2013).
4. Vazirani, V N, Ratwani M M. and S K Duggal "Analysis of Structures Vol. I", 17th Edition, Khanna Publishers, New Delhi.

B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - III			
FLUIDS MECHANICS			
Course Code	**18CV33**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: The objectives of this course is to make students to learn:

1. The Fundamental properties of fluids and its applications.
2. Hydrostatic laws and application to solve practical problem.
3. Principles of Kinematics and Hydrodynamics for practical applications.
4. Basic design of pipes and pipe networks considering flow, pressure and its losses.
5. The basic flow rate measurements.

Module-1

Fluids & Their Properties: Concept of fluid, Systems of units. Properties of fluid; Mass density, Specific weight, Specific gravity, Specific volume, Viscosity, Newton's law of viscosity (theory & problems), Cohesion, Adhesion, Surface tension, Pressure inside a water droplet, soap bubble and liquid jet. Numerical problems,& Capillarity. Capillary rise in a vertical tube and between two plane surfaces (theory & problems). Vapor pressure of liquid, compressibility and bulk modulus, Fluid as a continuum,

Fluid Pressure and Its Measurements: Definition of pressure, Pressure at a point, Pascal's law, Variation of pressure with depth. Types of pressure. Measurement of pressure using simple, differential & inclined manometers (theory & problems). Introduction to Mechanical and electronic pressure measuring devices.

Module-2

Hydrostatic forces on Surfaces: Definition, Total pressure, centre of pressure, total pressure on horizontal, vertical and inclined plane surface, total pressure on curved surfaces, water pressure on gravity dams, Lock gates. Numerical Problems.

Fundamentals of fluid flow (Kinematics): Introduction. Methods of describing fluid motion. Velocity and Total acceleration of a fluid particle. Types of fluid flow, Description of flow pattern. Basic principles of fluid flow, three- dimensional continuity equation in Cartesian coordinate system. Derivation for Rotational and irrational motion. Potential function, stream function, orthogonality of streamlines and equipotential lines. Numerical problems on Stream function and velocity potential. Introduction to flow net.

Module-3

Fluid Dynamics: Introduction. Forces acting on fluid in motion. Euler's equation of motion along a streamline and Bernoulli's equation. Assumptions and limitations of Bernoulli's equation. Modified Bernoulli's equation. Problems on applications of Bernoulli's equation (with and without losses).
Momentum equation problems on pipe bends.

Applications: Introduction. Venturi meter, Orifice meter, Pitot tube. Numerical Problems.

Module-4

Orifice and Mouth piece: Introduction, classification, flow through orifice, hydraulic coefficients and Numerical problems. Mouthpiece, classification, Borda's Mouthpiece (No problems).

Notches and Weirs: Introduction. Classification, discharge over rectangular, triangular, trapezoidal notches, Cippoletti notch, broad crested weirs. Numerical problems. Ventilation of weirs, submerged weirs.

Module-5

Flow through Pipes: Introduction. Major and minor losses in pipe flow. Darcy- Weis bach equation for head loss due to friction in a pipe. Pipes in series, pipes in parallel, equivalent pipe-problems. Minor losses in pipe flow, equation for head loss due to sudden expansion. Numerical problems. Hydraulic gradient line, energy gradient line. Numerical problems, .Pipe Networks, Hardy Cross method (No problems on pipe networks),

Surge Analysis in Pipes: Water hammer in pipes, equations for pressure rise due to gradual valve closure and sudden closure for rigid and elastic pipes. Problems.

Course outcomes: After successful completion of the course, the student will be able to:

1. Possess a sound knowledge of fundamental properties of fluids and fluid Continuum
2. Compute and solve problems on hydrostatics, including practical applications
3. Apply principles of mathematics to represent kinematic concepts related to fluid flow
4. Apply fundamental laws of fluid mechanics and the Bernoulli's principle for practical applications
5. Compute the discharge through pipes and over notches and weirs

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. P N Modi and S M Seth, "Hydraulics and Fluid Mechanics, including Hydraulic Machines", 20th edition, 2015, Standard Book House, New Delhi
2. R.K. Bansal, "A Text book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi
3. S K SOM and G Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill, New Delhi

Reference Books:

1. Victor L Streeter, Benjamin Wylie E and Keith W Bedford, "Fluid Mechanics", Tata McGraw Hill Publishing Co Ltd., New Delhi, 2008(Ed).
2. K Subramanya, "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Publishing Co. Ltd.
3. K Subramanya, "Fluid Mechanics and Hydraulic Machines-problems and solutions", Tata McGraw Hill Publishing Co. Ltd.
4. J. F. Douglas, J. M. Gasoriek, John Swaffield, Lynne Jack, "Fluid Mechanics", Pearson, Fifth Edition.
5. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

BUILDING MATERIALS AND CONSTRUCTION

Course Code	**18CV34**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will develop a student;

1. To recognize good construction materials based on properties.
2. To investigate soil properties and design suitable foundation.
3. To understand the types and properties of masonry materials and supervise masonry construction.
4. To gain knowledge of structural components like lintels, arches, staircase and roofs.
5. To understand the finishes in construction like flooring, plastering, paining.

Module-1

Building Materials: Stone as building material; Requirement of good building stones, Dressing of stones, Deterioration and Preservation of stone work. Bricks; Classification, Manufacturing of clay bricks, Requirement of good bricks. Field and laboratory tests on bricks; compressive strength, water absorption, efflorescence, dimension and warpage.

Cement Concrete blocks, Autoclaved Aerated Concrete Blocks, Sizes, requirement of good blocks.

Timber as construction material.

Fine aggregate: Natural and manufactured: Sieve analysis, zoning, specify gravity, bulking, moisture content, deleterious materials.

Coarse aggregate: Natural and manufactured: Importance of size, shape and texture. Grading of aggregates, Sieve analysis, specific gravity, Flakiness and elongation index, crushing, impact and abrasion tests.

Module-2

Foundation: Preliminary investigation of soil, safe bearing capacity of soil, Function and requirements of good foundation , types of foundation , introduction to spread, combined , strap, mat and pile foundation

Masonry: Definition and terms used in masonry. Brick masonry, characteristics and requirements of good brick masonry, Bonds in brick work, Header, Stretcher, English, Flemish bond, Stone masonry, Requirements of good stone masonry, Classification, characteristics of different stone masonry, Joints in stone masonry. Types of walls; load bearing, partition walls, cavity walls.

Module-3

Lintels and Arches: Definition, function and classification of lintels, Balconies, chejja and canopy. Arches; Elements and Stability of an Arch.

Floors and roofs: Floors; Requirement of good floor, Components of ground floor, Selection of flooring material Procedure for laying of Concrete (VDF), Mosaic, Kota, Slate, Marble, Granite, Tile flooring, Cladding of tiles.

Roof: Requirement of good roof, Types of roof, Elements of a pitched roof, Trussed roof, King post Truss, Queen Post Truss, Steel Truss, Different roofing materials, R.C.C. Roof.

Module-4

Doors, Windows and Ventilators: Location of doors and windows, technical terms, Materials for doors and windows: PVC, CPVC and Aluminum. Types of Doors and Windows: Paneled, Flush, Collapsible, Rolling shutter, Paneled and glazed Window, Bay Window, French window. Steel windows, Ventilators. Sizes as per IS recommendations.

Stairs: Definitions, technical terms and types of stairs: Wood, RCC, Metal. Requirements of good stairs. Geometrical design of RCC doglegged and open-well stairs.

Formwork: Introduction to form work, scaffolding, shoring, under pinning.

Module-5

Plastering and Pointing: Mortar and its types. Purpose, materials and methods of plastering and pointing: Sand faced plastering, Stucco plastering, lathe plastering, defects in plastering . Water proofing with various thicknesses.

Damp proofing- causes, effects and methods.

Paints- Purpose, types, technical terms, ingredients and defects, Preparation and applications of paints to new and old plastered surfaces, wooden and steel surfaces.

Course outcomes: After a successful completion of the course, the student will be able to:

1. Select suitable materials for buildings and adopt suitable construction techniques.
2. Decide suitable type of foundation based on soil parameters
3. Supervise the construction of different building elements based on suitability
4. Exhibit the knowledge of building finishes and form work requirements

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.

Textbooks:

1. Sushil Kumar "Building Materials and construction", 20th edition, reprint 2015,StandardPublishers
2. Dr. B. C. Punmia, Ashok kumar Jain, Arun Kumar Jain, "Building Construction, Laxmi Publications (P) ltd., New Delhi.
3. Rangawala S. C. "Engineering Materials", Charter Publishing House, Anand, India.

Reference Books:

1. S. K. Duggal, "Building Materials", (Fourth Edition)New Age International (P) Limited, 2016 National Building Code(NBC) of India
2. P C Vergese, "Building Materials", PHI Learning Pvt.Ltd
3. Building Materials and Components, CBRI, 1990,India
4. Jagadish. K.S, "Alternative Building Materials Technology", New Age International,2007.
5. M. S. Shetty, "Concrete Technology", S. Chand & Co. New Delhi.

B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER – III			
BASIC SURVEYING			
Course Code	**18CV35**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to;

1. Understand the basic principles of Surveying
2. Learn Linear and Angular measurements to arrive at solutions to basic surveying problems.
3. Employ conventional surveying data capturing techniques and process the data for computations.
4. Analyze the obtained spatial data to compute areas and volumes and draw contours to represent 3D data on plane figures.

Module-1

Introduction: Definition of surveying, Objectives and importance of surveying. Classification of surveys. Principles of surveying. Units of measurements, Surveying measurements and errors, types of errors, precision and accuracy. Classification of maps, map scale, conventional symbols, topographic maps, map layout, Survey of India Map numbering systems.

Measurement of Horizontal Distances: Measuring tape and types. Measurement using tapes, Taping on level ground and sloping ground. Errors and corrections in tape measurements, ranging of lines, direct and indirect methods of ranging, Electronic distance measurement, basic principle. Booking of tape survey work, Field book, entries, Conventional symbols, Obstacles in tape survey, Numerical problems.

Module-2

Measurement of Directions and Angles: Compass survey: Basic definitions; meridians, bearings, magnetic and True bearings. Prismatic and surveyor's compasses, temporary adjustments, declination. Quadrantal bearings, whole circle bearings, local attraction and related problems

Traversing: Traverse Survey and Computations: Latitudes and departures, rectangular coordinates, Traverse adjustments, Bowditch rule and transit rule, Numerical Problems.

Module-3

Leveling: Basic terms and definitions, Methods of leveling, Dumpy level, auto level, digital and laser levels. Curvature and refraction corrections. Booking and reduction of levels. Differential leveling, profile leveling, fly leveling, check leveling, reciprocal leveling.

Module-4

Plane Table Surveying: Plane table and accessories, Advantages and limitations of plane table survey, Orientation and methods of orientation, Methods of plotting – Radiation, Intersection, Traversing, Resection method, Two point and three point problems, Solution to two point problem by graphical method, Solution to three point problem Bessel's graphical method, Errors in plane table survey.

Module-5

Areas and Volumes: Measurement of area by dividing the area into geometrical figures, area from offsets, mid ordinate rule, trapezoidal and Simpson's one third rule, area from co-ordinates, introduction to planimeter, digital planimeter. Measurement of volumes- trapezoidal and prismoidal formula.

Contouring: Contours, Methods of contouring, Interpolation of contours, contour gradient, characteristics of contours and uses.

Course outcomes: After a successful completion of the course, the student will be able to:

1. Posses a sound knowledge of fundamental principles Geodetics
2. Measurement of vertical and horizontal plane, linear and angular dimensions to arrive at solutions to basic surveying problems.
3. Capture geodetic data to process and perform analysis for survey problems]
4. Analyse the obtained spatial data and compute areas and volumes. Represent 3D data on plane figures as contours

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. B.C. Punmia, "Surveying Vol.1", Laxmi Publications pvt. Ltd., New Delhi –2009.
2. Kanetkar T P and S V Kulkarni , Surveying and Leveling Part I, Pune VidyarthiGrihaPrakashan,1988

Reference Books:

1. S.K. Duggal, "Surveying Vol.1", Tata McGraw Hill Publishing Co. Ltd. New Delhi.2009.
2. K.R. Arora, "Surveying Vol. 1" Standard Book House, New Delhi. –2010
3. R Subramanian, Surveying and Leveling, Second edition, Oxford University Press, NewDelhi
4. A. Bannister, S. Raymond , R. Baker, "Surveying", Pearson, 7th ed., NewDelhi

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

ENGINEERING GEOLOGY

Course Code	**18CV36**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students;

1. To inculcate the importance of earth's interior and application of Geology in civil engineering. Attempts are made to highlight the industrial applications of minerals.
2. To create awareness among Civil engineers regarding the use of rocks as building materials.
3. To provide knowledge on dynamic Geology and its importance in modifying the physical character of rocks which cause rocks suitable or unsuitable in different civil engineering projects such as Dams, bridges, tunnels and highways.
4. To educate the ground water management regarding diversified geological formations, climatologically dissimilarity which are prevailed in the country. To highlight the concept of rain water harvesting.
5. To understand the application of Remote Sensing and GIS, Natural disaster and management and environmental awareness.

Module-1

Introduction: Application of Geology in Civil Engineering Practices, Understanding the earth, internal structure and composition.

Mineralogy: Mineral properties, composition and their use in the manufacture of construction materials – Quartz Group (Glass); Feldspar Group (Ceramic wares and Flooring tiles); Kaolin (Paper, paint and textile); Asbestos (AC sheets); Carbonate Group (Cement) ; Gypsum (POP, gypsum sheets, cement); Mica Group (Electrical industries); Ore minerals - Iron ores (Steel); Chro mite (Alloy); Bauxite (aluminum); Chalcopyrite (copper).

Module-2

Petrology & Geomorphology: Formation, Classification and Engineering Properties of: **Igneous rocks-**Types of Granite, Dolerite, Basalt, Pumice, Granite Porphyry. **Sedimentary Rocks-** Sandstone, Limestone, Shale, Late rite, Conglomerate. **Metamorphic Rocks-** Gneiss, Slate, Muscovite & Biotite schist, Marble, Quartzite. Rock weathering: types and their effects on Civil Engineering Projects. Landforms, Drainage pattern and types. Soil formation and soil profile. The apprehension of Index properties of rocks: Porosity, Density, Permeability, and Durability. Selection of rocks as materials for construction, as a foundation, Decorative, Flooring, and Roofing, Concrete Aggregate, Road Metal, Railway Ballast with examples.

Module-3

Structural Geology & Rock Mechanics: Structural aspects of rocks like Outcrop, Dip and strike, Folds, Faults, Joints, Unconformities and their influence on Engineering Projects/structures like dam, tunnels, slope treatment; ground improvement, recognition of the structures in field and their types/classification. Rock Quality Determination (RQD) & Rock Structure Rating (RSR). Geological site characterization: Dam foundations and rock Foundation treatment for dams and Reservoirs heavy structures by grouting and rock reinforcement. Tunnels: Basic terminology and application, site investigations, Coastlines and their engineering considerations.

Module-4

Hydrogeology: Hydrological cycle, Vertical distribution of groundwater, artesian groundwater in soil and rock. Water Bearing Formations, Aquifer and its types – Aquitard, Aquifuge, and Aquiclude. Porosity, Specific yield and retention, Permeability, Transmissibility and Storage Coefficient. Determination of Quality - SAR, RSC and TH of Groundwater. Groundwater Exploration- Electrical Resistivity and Seismic methods, Artificial Recharge of Groundwater, Rain water harvesting and methods, Seawater intrusion in coastal areas and remedies. Groundwater Pollution. Floods and its control, Cyclone and its effects.

Module-5

Seismology and Geodesy: Earthquake - Causes and Effects, Seismic waves, engineering problems related to Earthquakes, Earthquake intensity, Richter scale, Seismograph, Seismic zones- World and India. Tsunami causes and effects, Volcanic Eruptions. Landslides (Mass movements) causes, types and remedial measures –stability assessment for soil and rock slopes. Study of Topographic maps and Contour maps; Remote Sensing – Concept, Application and its Limitations; Geographic Information System (GIS) and Global Positioning System (GPS) –

Concept and their use resource mapping. Aerial Photography, LANDSAT Imagery – Definition and its use. Impact of Mining, Quarrying and Reservoirs on Environment. Natural Disasters and their mitigation

Course outcomes: After a successful completion of the course, the student will be able to:

1. Apply geological knowledge in different civil engineering practice.
2. Students will acquire knowledge on durability and competence of foundation rocks, and confidence enough to use the best building materials.
3. Civil Engineers are competent enough for the safety, stability, economy and life of the structures that they construct.
4. Able to solve various issues related to ground water exploration, build up dams, bridges, tunnels which are often confronted with ground water problems.
5. Intelligent enough to apply GIS, GPS and remote sensing as a latest tool in different civil engineering construction.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. P.K. Mukerjee, “A Text Book of Geology”, World Press Pvt., Ltd.Kolkatta.
2. Parbin Singh, “Text Book of Engineering and General Geology”, Published by S.K.Kataria and Sons, New Dehli.

Reference Books:

1. Earthquake Tips - Learning Earthquake Design and Construction - C V R Murthy Published by National Information Centre of Earthquake Engineering, Indian Institute of Technology, Kanpur. Dimitri P Krynine and William R Judd, “Principles of Engineering Geology and Geotechnics”, CBS Publishers and Distributors, New Delhi.
2. K V G K Gokhale, “Principles of Engineering Geology”, B S Publications, Hyderabad.
3. M Anji Reddy, “Text book of Remote Sensing and Geographical Information System”, BS Publications, Hyderabad.
5. M Anji Reddy, “Text book of Remote Sensing and Geographical Information System”, BS Publications, Hyderabad.
6. Ground water Assessment, development and Management by K.R. Karanth, Tata Mc Graw Hills
7. K. Todd, “Groundwater Hydrology”, Tata Mac Grow Hill, NewDelhi.
8. D. Venkata Reddy, “Engineering Geology”, New Age International Publications, NewDelhi.
9. S.K Duggal, H.K Pandey and N Rawal, “Engineering Geology”, McGrawHill Education (India) Pvt, Ltd. Ne Delhi.
10. M.P Billings, “Structural Geology”, CBS Publishers and Distributors, New Delhi.
11. K. S. Valdiya, “Environmental Geology”,, Tata Mc Grew Hills.
12. M. B. Ramachandra Rao, “Outlines of Geophysical Prospecting- A Manual for Geologists”, Prasaranga, University of Mysore, Mysore

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

COMPUTER AIDED BUILDING PLANNING AND DRAWING			
Course Code	**18CVL37**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(0:2:2)	SEE Marks	60
Total Number of Lecture/Practice Hours	02	Exam Hours	03

Course Learning Objectives: Provide students with a basic understanding

1. Achieve skill sets to prepare computer aided engineering drawings
2. Understand the details of construction of different building elements.
3. Visualize the completed form of the building and the intricacies of construction based on the engineering drawings.

Module:1

Drawing Basics: Selection of scales for various drawings, thickness of lines, dimensioning, abbreviations and conventional representations as per IS: 962.

Simple engineering drawings with CAD drawing tools : Lines, Circle, Arc, Poly line, Multiline, Polygon, Rectangle, Spline, Ellipse, Modify tools: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet, Using Text: Single line text, Multiline text, Spelling, Edit text, Special Features: View tools, Layers concept, Dimension tools, Hatching, Customizing toolbars, Working with multiple drawings.

Module:2

Drawings Related to Different Building Elements:
Following drawings are to be prepared for the data given using CAD Software

a) Cross section of Foundation, masonry wall, RCC columns with isolated & combined footings.
b) Different types of bonds in brick masonry.
c) Different types of staircases – Dog legged, Open well.
d) Lintel and chajja.
e) RCC slabs and beams.
f) Cross section of a pavement.
g) Septic Tank and sedimentation Tank.
h) Layout plan of Rainwater recharging and harvesting system.
i) Cross sectional details of a road for a Residential area with provision for all services.¸
j) Steel truss (connections Bolted).

Note: Students should sketch to dimension the above in a sketch book before doing the computer drawing.

Module -3:

Building Drawings: Principles of planning, Planning regulations and building bye-laws, factors affecting site selection, Functional planning of residential and public buildings, design aspects for different public buildings. Recommendations of NBC.

Drawing of Plan, elevation and sectional elevation including electrical, plumbing and sanitary services using CAD software for:

1. Single and double story residential building.
2. Hostel building.
3. Hospital building.
4. School building.

Submission drawing (sanction drawing) of two storied residential building with access to terrace including all details and statements as per the local bye-laws

Note:

- Students should sketch to dimension the above in a sketch book before doing the computer drawing
- One compulsory field visit/exercise to be carried out.
- Single line diagrams to be given in the examination.

Course Outcomes: After studying this course, students will be able to

1. Prepare, read and interpret the drawings in a professional set up.
2. KnowtheproceduresofsubmissionofdrawingsandDevelopworkingandsubmissiondrawingsforbuilding.
3. Plananddesignaresidentialorpublicbuildingasperthegivenrequirements.

Question paper pattern:

- There will be four full questions with sub divisions if necessary from Module2 with each full question carrying twenty five marks. Students have to answer any two questions.
- There will be two full questions from Module 3 with each full question carrying fifty marks. Students have to answer any one question. The conduction of examination and question paper format of should be in lines of 1st year CAED drawing. It's a drawing paper but the exam will be conducted by batches in the computer labs. Question papers should be given in batches.

Textbook:

1. MG Shah, CM Kale, SY Patki, "Building drawing with an integrated approach to Built Environment Drawing" , Tata McGraw Hill Publishing co. Ltd., New Delhi
2. Gurucharan Singh, "Building Construction", Standard Publishers, & distributors, New Delhi.
3. Malik R S and Meo G S, "Civil Engineering Drawing", Asian Publishers/Computech Publications Pvt Ltd.

Reference Books:

1. Time Saver Standard by Dodge F. W., F. W. Dodge Corp.
2. IS: 962-1989 (Code of practice for architectural and building drawing).
3. National Building Code, BIS, New Delhi.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

BUILDING MATERIALS TESTING LABORATORY

Course Code	**18CVL38**	**CIE Marks**	**40**
Teaching Hours/Week(L:T:P)	**(0:2:2)**	**SEE Marks**	**60**
Credits	**02**	**Exam Hours**	**03**

Course Learning Objectives: The objectives of this course is to make students to learn:

1. Ability to apply knowledge of mathematics and engineering in calculating the mechanical properties of structural materials.
2. Ability to function on multi-disciplinary teams in the area of materials testing.
3. Ability to use the techniques, skills and modern engineering tools necessary for engineering.
4. Understanding of professional and ethical responsibility in the areas of material testing.
5. Ability to communicate effectively the mechanical properties of materials.

Experiments:

1. Tension test on mild steel and HYSD bars.
2. Compression test on mild steel, cast iron and wood.
3. Torsion test on mild steel circular sections.
4. Bending Test on Wood Under two point loading.
5. Shear Test on Mild steel- single and double shear.
6. Impact test on Mild Steel (Charpy & Izod).
7. Hardness tests on ferrous and non-ferrous metals- Brinell's, Rockwell and Vicker's.
8. Tests on Bricks, Tiles and Concrete Blocks.
9. Tests on Fine aggregates-Moisture content, Specific gravity, Bulk density, Sieve analysis and Bulking.
10. Tests on Coarse aggregates-Absorption, Moisture content, specific gravity, Bulk density and Sieve analysis.
11. Demonstration of Strain gauges and Strain indicators.

NOTE: All tests to be carried out as per relevant latest BIS Codes

Course Outcomes: After successful completion of the course, the students will be able to:

1. Reproduce the basic knowledge of mathematics and engineering in finding the strength in tension, compression, shear and torsion.
2. Identify, formulate and solve engineering problems of structural elements subjected to flexure.
3. Evaluate the impact of engineering solutions on the society and also will be aware of contemporary issues regarding failure of structures due to unsuitable materials.

Question paper pattern:

- Group experiments - Tension test, compression test, torsion test and bending test.
- Individual Experiments – Remaining tests.
- Two questions are to be set - One from group experiments and the other as individual experiment.
- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.
- All exercises are to be included for practical examination.

Reference Books:

1. Davis, Troxell and Hawk, "Testing of Engineering Materials", International Student Edition – McGraw Hill Book Co. New Delhi.
2. M L Gambhir and Neha Jamwal, "Building and construction materials-Testing and quality control", McGraw Hill education (India)Pvt. Ltd.,2014.
3. Fenner, "Mechanical Testing of Materials", George Newnes Ltd. London.
4. Holes K A, "Experimental Strength of Materials", English Universities Press Ltd. London.
5. Suryanarayana A K, "Testing of Metallic Materials", Prentice Hall of India Pvt. Ltd. New Delhi.
6. Kukreja C B, Kishore K. and Ravi Chawla "Material Testing Laboratory Manual", Standard Publishers & Distributors1996.
7. Relevant **latest IS Codes.**

B. E. (Common to all Programmes) Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER –II / III / IV			
Aadalitha Kannada			
Course Code	**18KAK28/39/49**	CIE Marks	100
Teaching Hours/Week (L:T:P)	(0:2:0)		
Credits	01		

ಆಡಳಿತ ಕನ್ನಡ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

- ಪದವಿ ವಿದ್ಯಾರ್ಥಿಳಾಗಿರುವುದರಿಂದ ಆಡಳಿತ ಕನ್ನಡದ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
- ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾ ರಚನೆಯಲ್ಲಿನ ನಿಯಮಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾ ಬರಹದಲ್ಲಿ ಕಂಡುಬರುವ ದೋಷಗಳು ಹಾಗೂ ಅವುಗಳ ನಿವಾರಣೆ. ಮತ್ತು ಲೇಖನ ಚಿಹ್ನೆಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
- ಸಾಮಾನ್ಯ ಅರ್ಜಿಗಳು, ಸರ್ಕಾರಿ ಮತ್ತು ಅರೆ ಸರ್ಕಾರಿ ಪತ್ರವ್ಯವಹಾರದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು.
- ಭಾಷಾಂತರ ಮತ್ತು ಪ್ರಬಂಧ ರಚನೆ ಬಗ್ಗೆ ಅಸಕ್ತಿ ಮೂಡಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ ಮತ್ತು ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.

ಪರಿವಿಡಿ (ಪಠ್ಯಪುಸ್ತಕದಲ್ಲಿರುವ ವಿಷಯಗಳ ಪಟ್ಟಿ)

ಅಧ್ಯಾಯ – 1 ಕನ್ನಡಭಾಷೆ – ಸಂಕ್ಷಿಪ್ತ ವಿವರಣೆ.

ಅಧ್ಯಾಯ – 2 ಭಾಷಾ ಪ್ರಯೋಗದಲ್ಲಾಗುವ ಲೋಪದೋಷಗಳು ಮತ್ತು ಅವುಗಳ ನಿವಾರಣೆ.

ಅಧ್ಯಾಯ – 3 ಲೇಖನ ಚಿಹ್ನೆಗಳು ಮತ್ತು ಅವುಗಳ ಉಪಯೋಗ.

ಅಧ್ಯಾಯ – 4 ಪತ್ರ ವ್ಯವಹಾರ.

ಅಧ್ಯಾಯ – 5 ಆಡಳಿತ ಪತ್ರಗಳು.

ಅಧ್ಯಾಯ – 6 ಸರ್ಕಾರದ ಆದೇಶ ಪತ್ರಗಳು.

ಅಧ್ಯಾಯ – 7 ಸಂಕ್ಷಿಪ್ತ ಪ್ರಬಂಧ ರಚನೆ (ಪ್ರಿಸೈಸ್ ರೈಟಿಂಗ್), ಪ್ರಬಂಧ ಮತ್ತು ಭಾಷಾಂತರ.

ಅಧ್ಯಾಯ – 8 ಕನ್ನಡ ಶಬ್ದಸಂಗ್ರಹ.

ಅಧ್ಯಾಯ – 9 ಕಂಪ್ಯೂಟರ್ ಹಾಗೂ ಮಾಹಿತಿ ತಂತ್ರಜ್ಞಾನ.

ಅಧ್ಯಾಯ – 10 ಪಾರಿಭಾಷಿಕ ಆಡಳಿತ ಕನ್ನಡ ಪದಗಳು ಮತ್ತು ತಾಂತ್ರಿಕ/ ಕಂಪ್ಯೂಟರ್ ಪಾರಿಭಾಷಿಕ ಪದಗಳು.

ಆಡಳಿತ ಕನ್ನಡ ಕಲಿಕೆಯ ಫಲಿತಾಂಶ'ಗಳು:

- ಆಡಳಿತ ಭಾಷೆ ಕನ್ನಡದ ಪರಿಚಯವಾಗುತ್ತದೆ.
- ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡುತ್ತದೆ.
- ಕನ್ನಡ ಭಾಷಾ ರಚನೆಯಲ್ಲಿನ ನಿಯಮಗಳು ಮತ್ತು ಲೇಖನ ಚಿಹ್ನೆಗಳು ಪರಿಚಯಿಸಲ್ಪಡುತ್ತವೆ.
- ಸಾಮಾನ್ಯ ಅರ್ಜಿಗಳು, ಸರ್ಕಾರಿ ಮತ್ತು ಅರೆ ಸರ್ಕಾರಿ ಪತ್ರವ್ಯವಹಾರದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡುತ್ತದೆ.
- ಭಾಷಾಂತರ ಮತ್ತು ಪ್ರಬಂಧ ರಚನೆ ಬಗ್ಗೆ ಅಸಕ್ತಿ ಮೂಡುತ್ತದೆ.
- ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ ಮತ್ತು ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳು ಪರಿಚಯಿಸಲ್ಪಡುತ್ತವೆ.

ಪರೀಕ್ಷೆಯ ವಿಧಾನ : ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ – ಅಖಇ **(ಅಔಟಿಣuಟಿಣಾ ಖಟಿಣಜಡಿಟಿಚಿಟ ಇತಿಚಿಟಣಚಿಣuಟಿ):**

ಕಾಲೇಜು ಮಟ್ಟದಲ್ಲಿಯೆ ಆಂತರಿಕ ಪರೀಕ್ಷೆಯನ್ನು 100 ಅಂಕಗಳಿಗೆ ವಿಶ್ವವಿದ್ಯಾಲಯದ ನಿಯಮಗಳು ಮತ್ತು ನಿರ್ದೇಶನದಂತೆ ನಡೆಸತಕ್ಕದ್ದು.

ಪಠ್ಯಪುಸ್ತಕ : ಆಡಳಿತ ಕನ್ನಡ ಪಠ್ಯ ಪುಸ್ತಕ (ಏಚಿಟಿಟಿಚಿಜಚಿ ಜಿಊ ಂಜಟ್ಮಡಿಚಿಣuಟಿ)

ಸ'ಂಪಾದಕರು

ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ

ಪ್ರೊ. ವಿ. ಕೇಶವಮೂರ್ತಿ

ಪ್ರಕಟಣೆ : ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

B. E. (Common to all Programmes)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER –II & III/IV

Vyavaharika Kannada

Course Code	**18KVK28/39/49**	CIE Marks	100
Teaching Hours/Week (L:T:P)	(0:2:0)		
Credits	01		

Course Learning Objectives:

The course will enable the students to understand Kannada and communicate in Kannada language.

Table of Contents:

Chapter - 1: Vyavaharika kannada – Parichaya (Introduction to Vyavaharika Kannada).
Chapter - 2: Kannada Aksharamale haagu uchcharane (Kannada Alpabets and Pronunciation).
Chapter - 3: Sambhashanegaagi Kannada Padagalu (Kannada Vocabulary for Communication).
Chapter - 4: Kannada Grammar in Conversations (Sambhashaneyalli Kannada Vyakarana).
Chapter - 5: Activities in Kannada.

Course Outcomes:

At the end of the course, the student will be able to understand Kannada and communicate in Kannada language.

ಪರೀಕ್ಷೆಯ ವಿಧಾನ : ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ – ಅಖಇ **(ಅಠಿಣಟಿಣಣಾ ಖಟಿಣಜಖಿಟಿಚಿಟ ಇತಿಚಿಟಣಚಿಣಾಟಿ):**

ಕಾಲೇಜು ಮಟ್ಟದಲ್ಲಿಯೆ ಆಂತರಿಕ ಪರೀಕ್ಷೆಯನ್ನು 100 ಅಂಕಗಳಿಗೆ ವಿಶ್ವವಿದ್ಯಾಲಯದ ನಿಯಮಗಳು ಮತ್ತು ನಿರ್ದೇಶನದಂತೆ ನಡೆಸತಕ್ಕದ್ದು.

ಖಿಜಣಾಛಿಣಾ (ಪಠ್ಯಪುಸ್ತಕ): ವ್ಯಾವಹಾರಿಕ ಕನ್ನಡ ಪಠ್ಯ ಪುಸ್ತಕ (ಗಿಥಿಚಿತಿಚಿಡಿಚಿ ಏಚಿಟಿಟಿಚಿಜಚಿ ಖಿಜಥಿ ಃಣಾ)

ಸಂಪಾದಕರು

ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ

ಪ್ರೊ. ವಿ. ಕೇಶವಮೂರ್ತಿ

ಪ್ರಕಟಣೆ : ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

B. E. AUTOMOBILE ENGINEERING
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER - III

CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND CYBER LAW (CPC)

Course Code	**18CPC39/49**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(1:0:0)	SEE Marks	60
Credits	01	Exam Hours	02

Course Learning Objectives: To

- know the fundamental political codes, structure, procedures, powers, and duties of Indian government institutions, fundamental rights, directive principles, and the duties of citizens
- Understand engineering ethics and their responsibilities; identify their individual roles and ethical responsibilities towards society.
- Know about the cybercrimes and cyber laws for cyber safety measures.

Module-1

Introduction to Indian Constitution: The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian constitution, The Making of the Constitution, The Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India. Fundamental Rights and its Restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and significance in Nation building.

Module-2

Union Executive and State Executive: Parliamentary System, Federal System, Centre-State Relations. Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism. State Executives – Governor, Chief Minister, State Cabinet, State Legislature, High Court and Subordinate Courts, Special Provisions (Articles 370.371,371J) for some States.

Module-3

Elections, Amendments and Emergency Provisions: Elections, Electoral Process, and Election Commission of India, Election Laws. Amendments - Methods in Constitutional Amendments (How and Why) and Important Constitutional Amendments. Amendments – 7,9,10,12,42,44, 61, 73,74, ,75, 86, and 91,94,95,100,101,118 and some important Case Studies. Emergency Provisions, types of Emergencies and its consequences.

Constitutional special provisions: Special Provisions for SC and ST, OBC, Women, Children and Backward Classes.

Module-4

Professional / Engineering Ethics: Scope & Aims of Engineering & Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Engineering and Professionalism, Positive and Negative Faces of Engineering Ethics, Code of Ethics as defined in the website of Institution of Engineers (India): Profession, Professionalism, and Professional Responsibility. Clash of Ethics, Conflicts of Interest. Responsibilities in Engineering Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. Trust and Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering

Module-5

Internet Laws, Cyber Crimes and Cyber Laws: Internet and Need for Cyber Laws, Modes of Regulation of Internet, Types of cyber terror capability, Net neutrality, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000, Internet Censorship. Cybercrimes and enforcement agencies.

Course Outcomes: On completion of this course, students will be able to,

- CO1: Have constitutional knowledge and legal literacy.
- CO2: Understand Engineering and Professional ethics and responsibilities of Engineers.
- CO3: Understand the the cybercrimes and cyber laws for cyber safety measures.

Question paper pattern for SEE and CIE:

- The SEE question paper will be set for 100 marks and the marks scored by the students will proportionately be reduced to 60. The pattern of the question paper will be objective type (MCQ).
- For the award of 40 CIE marks, refer the University regulations 2018.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year

Textbooks				
1	Constitution of India, Professional Ethics and Human Rights	Shubham Singles, Charles E. Haries, and et al	Cengage Learning India	2018
2	Cyber Security and Cyber Laws	Alfred Basta and et al	Cengage Learning India	2018
Reference Books				
3	Introduction to the Constitution of India	Durga Das Basu	Prentice –Hall,	2008.
4	Engineering Ethics	M. Govindarajan, S. Natarajan, V. S. Senthilkumar	Prentice –Hall,	2004

B. E. Common to all Programmes
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

ADDITIONAL MATHEMATICS – I
(Mandatory Learning Course: Common to All Programmes)
(A Bridge course for Lateral Entry students under Diploma quota to BE/B. Tech programmes)

Course Code	**18MATDIP31**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	0	Exam Hours	03

Course objectives:
- To provide basic concepts of complex trigonometry, vector algebra, differential and integral calculus.
- To provide an insight into vector differentiation and first order ODE's.

Module-1

Complex Trigonometry: Complex Numbers: Definitions and properties. Modulus and amplitude of a complex number, Argand's diagram, De-Moivre's theorem (without proof).
Vector Algebra: Scalar and vectors. Addition and subtraction and multiplication of vectors- Dot and Cross products, problems.

Module-2

Differential Calculus: Review of successive differentiation-illustrative examples. Maclaurin's series expansions-Illustrative examples. Partial Differentiation: Euler's theorem-problems on first order derivatives only. Total derivatives-differentiation of composite functions. Jacobians of order two-Problems.

Module-3

Vector Differentiation: Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and vector point functions. Gradient, Divergence, Curl-simple problems. Solenoidal and irrotational vector fields-Problems.

Module-4

Integral Calculus: Review of elementary integral calculus. Reduction formulae for $\sin^n x$, $\cos^n x$ (with proof) and $\sin^m x \cos^n x$ (without proof) and evaluation of these with standard limits-Examples. Double and triple integrals-Simple examples.

Module-5

Ordinary differential equations (ODE's. Introduction-solutions of first order and first degree differential equations: exact, linear differential equations. Equations reducible to exact and Bernoulli's equation.

Course outcomes: At the end of the course the student will be able to:
- CO1: Apply concepts of complex numbers and vector algebra to analyze the problems arising in related area.
- CO2: Use derivatives and partial derivatives to calculate rate of change of multivariate functions.
- CO3: Analyze position, velocity and acceleration in two and three dimensions of vector valued functions.
- CO4: Learn techniques of integration including the evaluation of double and triple integrals.

CO5: Identify and solve first order ordinary differential equations.

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook				
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	43rd Edition,

				2015
Reference Books				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10^{th} Edition, 2015
2	Engineering Mathematics	N.P.Bali and Manish Goyal	Laxmi Publishers	7th Edition, 2007
3	Engineering Mathematics Vol.I	Rohit Khurana	Cengage Learning	1^{st} Edition, 2015

B.E.(Common to all Programmes)

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

SEMESTER - IV

COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS

(Common to all Programmes)

[As per Choice Based Credit System (CBCS) scheme]

Course Code	**18MAT41**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	3	Exam Hours	03

Course Learning Objectives:

- To provide an insight into applications of complex variables, conformal mapping and special functions arising in potential theory, quantum mechanics, heat conduction and field theory.
- To develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in digital signal processing, design engineering and microwave engineering.

Module-1

Calculus of complex functions: Review of function of a complex variable, limits, continuity, and differentiability. Analytic functions: Cauchy-Riemann equations in Cartesian and polar forms and consequences. Construction of analytic functions: Milne-Thomson method-Problems.

Module-2

Conformal transformations: Introduction. Discussion of transformations: $w=z^2$, $w=e^z$, $w = z + \frac{1}{z}, (z \neq 0)$. Bilinear transformations- Problems.

Complex integration: Line integral of a complex function-Cauchy's theorem and Cauchy's integral formula and problems.

Module-3

Probability Distributions: Review of basic probability theory. Random variables (discrete and continuous), probability mass/density functions. Binomial, Poisson, exponential and normal distributions- problems (No derivation for mean and standard deviation)-Illustrative examples.

Module-4

Curve Fitting: Curve fitting by the method of least squares- fitting the curves of the form- $y = ax + b, y = ax^b$ & $y = ax^2 + bx + c.$

Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation-problems. Regression analysis- lines of regression –problems.

Module-5

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation and covariance.

Sampling Theory: Introduction to sampling distributions, standard error,Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.

Course outcomes: At the end of the course the student will be able to:

- CO1: Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory.
- CO2: Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing.
- CO3: Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.
- CO4: Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
- CO5: Construct joint probability distributions and demonstrate the validity of testing the hypothesis.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10th Edition,2016
2	Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers	44th Edition, 2017
3	Engineering Mathematics	Srimanta Pal et al	Oxford University Press	3rd Edition,2016
Reference Books				
1	Advanced Engineering Mathematics	C. Ray Wylie, Louis C. Barrett	McGraw-Hill	6th Edition 1995
2	Introductory Methods of Numerical Analysis	S. S. Sastry	Prentice Hall of India	4th Edition 2010
3	Higher Engineering Mathematics	B.V. Ramana	McGraw-Hill	11th Edition,2010
4	A Textbook of Engineering Mathematics	N. P. Bali and Manish Goyal	Laxmi Publications	6th Edition, 2014
5	Advanced Engineering Mathematics	Chandrika Prasad and Reena Garg	Khanna Publishing,	2018

Web links and Video Lectures:

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU EDUSAT PROGRAMME - 20

B. E. CIVIL ENGINEERING
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – IV
ANALYSIS OF DETERMINATE STRUCTURES

Course Code	**18CV42**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives: This course will enable students to
1. To understand different forms of structural systems.
2. To understand concept of ILD and moving loads.
3. To determine slopes and deflections of beams and trusses.
4. To analyse arches and cables.

Module-1

Introduction and Analysis of Plane Trusses: Structural forms, Conditions of equilibrium, Compatibility conditions, Degree of freedom, Linear and non linear analysis, Static and kinematic indeterminacies of structural systems.

Influence Lines: Concepts of influence lines-ILD for reactions, SF and BM for determinate beams-ILD for axial forces in determinate trusses and numerical problems.

Module-2

Moving Loads: Reactions, BM and SF in determinate beams, axial forces in determinate trusses for rolling loads using ILD (Max. values and absolute max. values for beams subjected to multiple loads).

Module-3

Deflection of Beams: Moment area method: Derivation, Mohr's theorems, Sign conventions, Application of moment area method for determinate prismatic beams, Beams of varying section, Use of moment diagram by parts. Conjugate beam method: Real beam and conjugate beam, conjugate beam theorems, Application of conjugate beam method of determinate beams of variable cross sections

Module-4

Energy Principles and Energy Theorems: Principle of virtual displacements, Principle of virtual forces, Strain energy and complimentary energy, Strain energy due to axial force, bending, shear and torsion, Deflection of determinate beams and trusses using total strain energy, Deflection at the point of application of single load, Castig liano's theorems and its application to estimate the deflections of trusses, bent frames, Special applications-Dummy unit load method.

Module-5

Arches and Cable Structures: Three hinged parabolic and circular arches with supports at the same and different levels. Determination of normal thrust, radial shear and bending moment. Analysis of cables under point loads and UDL. Length of cables for supports at same and at different levels- Stiffening trusses for suspension cables.

Course Outcomes: After studying this course, students will be able to:
1. Identify different forms of structural systems.
2. Construct ILD and analyse the beams and trusses subjected to moving loads
3. Understand the energy principles and energy theorems and its applications to determine the deflections of trusses and beams.
4. Determine the stress resultants in arches and cables.

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.

The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Reddy C S, Basic Structural Analysis, Tata McGraw Hill, New Delhi.
2. Muthu K U. etal, Basic Structural Analysis, 2nd edition, IK International Pvt. Ltd., NewDelhi,2015.
3. Bhavikatti, Structual Analysis, Vikas Publishing House Pvt. Ltd, New Delhi,2002.

Reference Books:

1. Hibbeler R C, Structural Analysis, Prentice Hall, 9th edition,2014.

2. Devadoss Menon, Structural Analysis, Narosa Publishing House, New Delhi,2008.
3. Prakash Rao D S, Structural Analysis, University Press Pvt. Ltd,2007.

CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

APPLIED HYDRAULICS

Course Code	**18CV43**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: The objectives of this course is to make students to learn:

1. Principles of dimensional analysis to design hydraulic models and Design of various models.
2. Design the open channels of various cross sections including design of economical sections.
3. Energy concepts of fluid in open channel, Energy dissipation, Water surface profiles at different conditions.
4. The working principles of the hydraulic machines for the given data and analyzing the performance of Turbines for various design data.

Module-1

Dimensional analysis: Dimensional analysis and similitude: Dimensional homogeneity, Non Dimensional parameter, Rayleigh methods and Buckingham ð theorem, dimensional analysis, choice of variables, examples on various applications. **Model analysis:** Model analysis, similitude, types of similarities, force ratios, similarity laws, model classification, Reynolds model, Froude's model, Euler's Model, Webber's model, Mach model, scale effects, Distorted models. Numerical problems on Reynolds's, and Froude's Model

Buoyancy and Flotation: Buoyancy, Force and Centre of Buoyancy, Meta centre and Meta centric height, Stability of submerged and floating bodies, Determination of Meta centric height, Experimental and theoretical method, Numerical problems.

Module-2

Open Channel Flow Hydraulics: Uniform Flow: Introduction, Classification of flow through channels, Chezy's and Manning's equation for flow through open channel, Most economical channel sections, Uniform flow through Open channels, Numerical Problems. Specific Energy and Specific energy curve, Critical flow and corresponding critical parameters, Numerical Problems

Module-3

Non-Uniform Flow: Hydraulic Jump, Expressions for conjugate depths and Energy loss, Numerical Problems Gradually varied flow, Equation, Back water curve and afflux, Description of water curves or profiles, Mild, steep, critical, horizontal and adverse slope profiles, Numerical problems on identifying the flow profiles

Module-4

Impact of jet on Curved vanes: Introduction, Impulse-Momentum equation. Direct impact of a jet on stationary and moving curved vanes, Introduction to concept of velocity triangles, impact of jet on a series of curved vanes- Problems.

Turbines – Impulse Turbines: Introduction to turbines, General lay out of a hydro- electric plant, Heads and Efficiencies, classification of turbines. Pelton wheel- components, working principle and velocity triangles. Maximum power, efficiency, working proportions – Numerical problems.

Module-5

Reaction Turbines and Pumps: Radial flow reaction turbines: (i) Francis turbine- Descriptions, working proportions and design, Numerical problems. (ii) Kaplan turbine- Descriptions, working proportions and design, Numerical problems. Draft tube theory and unit quantities. (No problems)

Centrifugal pumps: Components and Working of centrifugal pumps, Types of centrifugal pumps, Work done by the impeller, Heads and Efficiencies, Minimum starting speed of centrifugal pump, Numerical problems, Multi-stage pumps.

Course outcomes: After a successful completion of the course, the student will be able to:

1. Apply dimensional analysis to develop mathematical modeling and compute the parametric values in prototype by analyzing the corresponding model parameters
2. Design the open channels of various cross sections including economical channel sections
3. Apply Energy concepts to flow in open channel sections, Calculate Energy dissipation,
4. Compute water surface profiles at different conditions
5. Design turbines for the given data, and to know their operation characteristics under different operating conditions

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. P N Modi and S M Seth, "Hydraulics and Fluid Mechanics, including Hydraulic Machines", 20th edition, 2015, Standard Book House, NewDelhi
2. R.K. Bansal, "A Text book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi
3. S K SOM and G Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill, New Delhi.

Reference Books:

1. K Subramanya, "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Publishing Co.Ltd.
2. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford UniversityPress.
3. C.S.P. Ojha, R. Berndtsson, and P.N. Chandramouli, "Fluid Mechanics and Machinery", Oxford University Publication –2010.
4. J.B. Evett, and C. Liu, "Fluid Mechanics and Hydraulics", McGraw-Hill Book Company.-2009.

CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

CONCRETE TECHNOLOGY

Course Code	**18CV44**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to:

1. To recognize material characterization of ingredients of concrete and its influence on properties of concrete
2. Proportion ingredients of Concrete to arrive at most desirable mechanical properties of Concrete.
3. Ascertain and measure engineering properties of concrete in fresh and hardened state which meet the requirement of real time structures.

Module-1

Concrete Ingredients Cement – Cement manufacturing process, steps to reduce carbon footprint, chemical composition and their importance, hydration of cement, types of cement. Testing of cement. Fine aggregate: Functions, requirement, Alternatives to River sand, M-sand introduction and manufacturing. Coarse aggregate: Importance of size, shape and texture. Grading and blending of aggregate. Testing on aggregate, requirement. Recycled aggregates Water – qualities of water. Chemical admixtures – plasticizers, accelerators, retarders and air entraining agents. Mineral admixtures – Pozzolanic and cementitious materials, Fly ash, GGBS, silica fumes, Metakaolin and rice huskash.

Module-2

Fresh Concrete Workability-factors affecting workability. Measurement of workability–slump, Compaction factor and Vee-Bee Consistometer tests, flow tests. Segregation and bleeding. Process of manufacturing of concrete- Batching, Mixing, Transporting, Placing and Compaction. Curing – Methods of curing – Water curing, membrane curing, steam curing, accelerated curing, self- curing. Good and Bad practices of making and using fresh concrete and Effect of heat of hydration during mass concreting at project sites.

Module-3

Hardened Concrete Factors influencing strength, W/C ratio, gel/space ratio, Maturity concept, Testing of hardened concrete, Creep –facto rs affecting creep. Shrinkage of concrete – plastic shrinking and drying shrinkage, Factors affecting shrinkage. Definition and significance of durability. Internal and external factors influencing durability, Mechanisms- Sulphate attack – chloride attack, carbonation, freezing and thawing. Corrosion, Durability requirements as per IS-456, In situ testing of concrete- Penetration and pull out test, rebound hammer test, ultrasonic pulse velocity, core extraction – Principal, applications and limitations.

Module-4

Concrete Mix Proportioning

Concept of Mix Design with and without admixtures, variables in proportioning and Exposure conditions, Selection criteria of ingredients used for mix design, Procedure of mix proportioning. Numerical Examples of Mix Proportioning using IS-10262:2019.

Module-5

Special Concretes

RMC- manufacture and requirement as per QCI-RMCPCS, properties, advantages and disadvantages. Self-Compacting concrete- concept, materials, tests, properties, application and typical mix Fiber reinforced concrete - Fibers types, properties, application of FRC. Light weight concrete-material properties and types. Typical light weight concrete mix and applications, materials, requirements, mix proportion and properties of Geo polymer Concrete, High Strength Concrete and High Performance Concrete.

Course outcomes: After studying this course, students will be able to:

1. Relate material characteristics and their influence on microstructure of concrete.
2. Distinguish concrete behavior based on its fresh and hardened properties.
3. Illustrate proportioning of different types of concrete mixes for required fresh and hardened properties using professional codes.
4. Adopt suitable concreting methods to place the concrete based on requirement.
5. Select a suitable type of concrete based on specific application.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Neville A.M. "Properties of Concrete"-4th Ed., Longman.
2. M.S. Shetty, Concrete Technology - Theory and Practice Published by S. Chand and Company, New Delhi.
3. Kumar Mehta. P and Paulo J.M. Monteiro "Concrete-Microstructure, Property and Materials", 4th Edition, McGraw Hill Education, 2014
4. A.R. Santha Kumar, "Concrete Technology", Oxford Un iversity Press, New Delhi (NewEdition).

Reference Books:

1. M L Gambir, "Concrete Technology", McGraw Hill Education,2014.
2. N. V. Nayak, A. K. Jain Handbook on Advanced Concrete Technology, ISBN: 978-81-8487-186-9
3. Job Thomas, "Concrete Technology", CENGAGE Learning,2015.
4. IS 4926 (2003): Code of Practice Ready-Mixed Concrete [CED 2: Cement and Concrete] Criteria for RMC Production Control, Basic Level Certification for Production Control of Ready Mixed Concrete-BMTPC.
5. Specification and Guidelines for Self-Compacting Concrete, EFNARC, Association House.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

ADVANCED SURVEYING

Course Code	**18CV45**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Objectives: This course will enable students to
1. Apply geometric principles to arrive at solutions to surveying problems.
2. Analyze spatial data using appropriate computational and analytical techniques.
3. Design proper types of curves for deviating type of alignments.
4. Use the concepts of advanced data capturing methods necessary for engineering practice

Module-1

Theodolite Survey and Instrument Adjustment: Theodolite and types, Fundamental axes and parts of Transit theodolite, uses of theodolite, Temporary adjustments of transit theodolite, measurement of horizontal and vertical angles, step by step procedure for obtaining permanent adjustment of Transit theodolite.
Trigonometric Levelling: Trigonometric leveling (heights and distances-single plane and double plane methods).

Module-2

Tacheometry: Basic principle, types of tacheometry, distance equation for horizontal and inclined line of sight in fixed hair method, problems.
Geodetic Surveying: Principle and Classification of triangulation system, Selection of base line and stations, Orders of triangulation, Triangulation figures, Reduction to Centre, Selection and marking of stations.

Module-3

Curve Surveying:
Curves – Necessity – Types, Simple curves, Elements , Designation of curves, Setting out simple curves by linear methods (numerical problems on offsets from long chord & chord produced method), Setting out curves by Rankines deflection angle method (Numerical problems). Compound curves, Elements, Design of compound curves, Setting out of compound curves (numerical problems). Reverse curve between two Parallel straights (numerical problems on Equal radius and unequal radius). Transition curves Characteristics, numerical problems on Length of Transition curve, Vertical curves & Types – (theory).

Module-4

Aerial Photogrammetry
Introduction, Uses, Aerial photographs, Definitions, Scale of vertical and tilted photograph (simple problen Ground Co-ordinates (simple problems), Relief Displacements (Derivation), Ground control, Procedure of ae survey, overlaps and mosaics, Stereoscopes, Derivation Parallax.

Module-5

Modern Surveying Instruments
Introduction, Electromagnetic spectrum, Electromagnetic distance measurement, Total station, Lidar scanners for topographical survey.

Remote Sensing: Introduction, Principles of energy interaction in atmosphere and earth surface features, Image interpretation techniques, visual interpretation. Digital image processing, Global Positioning system
Geographical Information System: Definition of GIS, Key Components of GIS, Functions of GIS, Spatial data, spatial information system Geospatial analysis, Integration of Remote sensing and GIS and Applications in Civil Engineering(transportation, town planning).

Course outcomes: After a successful completion of the course, the student will be able to:

1. Apply the knowledge of geometric principles to arrive at surveying problems
2. Use modern instruments to obtain geo-spatial data and analyse the same to appropriate engineering problems.
3. Capture geodetic data to process and perform analysis for survey problems with the use of electronic instruments;
4. Design and implement the different types of curves for deviating type of alignments.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. B.C. Punmia, "Surveying Vol.2", Laxmi Publications pvt. Ltd., New Delhi.
2. Kanetkar T P and S V Kulkarni , Surveying and Leveling Part 2, Pune Vidyarthi Griha Prakashan,
3. K.R. Arora, "Surveying Vol. 1" Standard Book House, New Delhi.
4. SateeshGopi, Global Positioning System, Tata McGraw Hill Publishing Co. Ltd. New Delhi.

Reference Books:

1. S.K. Duggal, "Surveying Vol. I & II", Tata McGraw Hill Publishing Co. Ltd. New Delhi.
2. R Subramanian, Surveying and Leveling, Second edition, Oxford University Press, New Delhi.
3. David Clerk, Plane and Geodetic Surveying Vol1 and Vol2, CBSpublishers
4. B Bhatia, Remote Sensing and GIS, Oxford University Press, New Delhi.
5. T.M Lillesand, R.W Kiefer,. and J.W Chipman, Remote sensing and Image interpretation , 5th edition, John Wiley and SonsIndia
6. James M Anderson and Adward M Mikhail, Surveying theory and practice, 7th Edition, Tata McGraw HillPublication.
7. Kang-tsung Chang, Introduction to geographic information systems, McGraw Hill HigherEducation.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

WATER SUPPLY AND TREATMENT ENGINEERING

Course Code	**18CV46**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Analyze the variation of water demand and to estimate water requirement for a community.
2. Evaluate the sources and conveyance systems for raw and treated water.
3. Study drinking water quality standards and to illustrate qualitative analysis of water.
4. Design physical, chemical and biological treatment methods to ensure safe and potable water Supply.

Module -1

Introduction: Need for protected water supply. Demand of Water: Types of water demands -domestic demand, industrial, institutional and commercial, public use, fire demand estimation, factors affecting per capita demand, Variations in demand of water, Peak factor.

Design period and factors governing design period. Methods of population forecasting and numerical problems

Module -2

Water Treatment: Objectives, Unit flow diagrams – significance of each unit: Sources and Characteristics of surface and subsurface sources and Suitability. Sampling : Objectives, methods and preservation techniques. Drinking water quality standards as per BIS. Effect of water quality parameters.

Intake structures – types. Factors to be considered in selection of site for intake structures. Aeration process, limitations, types and two film theory.

Module -3

Sedimentation -theory, settling tanks, types and design. Coagulation and flocculation, Clarriflocculators (circular and rectangular). theory, types of coagulants, coagulant feeding devices. Jar test apparatus and estimation of coagulants.

Filtration: mechanism, theory of filtration, types of filters: slow sand, rapid sand and pressure filters. Operation, cleaning. Operational problems in filters. Design of slow and rapid sand filter without under drainage system

Module -4

Disinfection: Theory of disinfection. Methods of disinfection with merits and demerits. Chlorination: Break point chlorination and determination of chlorine demand. Estimation of quantity bleaching powder.

Miscellaneous treatment Process: Softening: Lime soda and Zeolite process. Estimation of Hardness. Fluoridation and De-fluoridation, Nalagonda Technique. RO and Nano filtration process with merits and demerits.

Module -5

Collection and Conveyance of water: Types of pumps with working principles and numerical Problems. Design of the economical diameter for the rising main.

Pipe appurtenances, Valves, Fire hydrants and different Pipe materials with their advantages and disadvantages. Factors affecting selection of pipe material.

Distribution system: Methods: Gravity, Pumping and Combined gravity and pumping system. Types of Distribution system. Service reservoirs and their capacity determination plant units and distribution system with population forecasting for the given city.

Course Outcomes: After studying this course, students will be able to:

1. Estimate average and peak water demand for a community.
2. Evaluate available sources of water, quantitatively and qualitatively and make appropriate choice for a community.
3. Evaluate water quality and environmental significance of various parameters and plan suitable treatment system.
4. Design a comprehensive water treatment and distribution system to purify and distribute water to the required quality standards.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Howard S. Peavy, Donald R. Rowe, George T , Environmental Engineering - McGraw Hill International Edition. New York,2000
2. S. K. Garg, Environmental Engineering vol-I, Water supply Engineering – M/s Khanna Publishers, New Delhi2010
3. B.C. Punmia and Ashok Jain, Environmental Engineering I-Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi2010.

Reference Books:

1. CPHEEO Manual on water supply and treatment engineering, Ministry of Urban Development, Government of India, New Delhi.
2. Mark.J Hammer, Water & Waste Water Technology, John Wiley & Sons Inc., New York,2008.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

ENGINEERING GEOLOGY LABORATORY

Course Code	**18CVL47**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives: This course will enable students

1. To expose the students to identify the minerals and rocks based on their inherent properties and uses in civil engineering,
2. To educate the students in the interpretation of the geological maps related to civil engineering projects.
3. Students will learn the dip and strike, thickness of strata, Bore hole problems related to geological formation related to foundation, tunnels, reservoirs and mining.
4. Students will understand the Field knowledge by visiting the site like problems Faults, Folds, Joints, Unconformity etc.

Experiments

1. Physical properties of minerals: Identification of
   i. **Rock Forming minerals -** Quartz group, Feldspar group, Garnet group, Mica group & Talc, Chlorite, Olivine, Asbestos, Calcite, Gypsum, etc
   ii. **Ore forming minerals-** Magnetite, Hematite, Pyrite, Pyralusite, Graphite, Chromite, etc

2. Engineering Properties of Rocks: Identification of
   i. **Igneous rocks-** Types of Granites, Dolerite, Granite Porphyry, Basalt, Pumice etc
   ii. **Sedimentary rocks-** Sandstone, Lime stone, Shale, Laterite, Breccia etc
   iii. **Metamorphic rocks-** Gneiss, Slate, Schist, Marble, Quartzite etc

3. Borehole problems: Determination of subsurface behavior of rocks, their attitude related to foundation, tunnels, reservoirs and mining. Triangular and Square methods. (2 methods)

4. Dip and Strike problems. Determine Apparent dip and True dip. (2 methods)

5. Calculation of Vertical, True thickness and width of the outcrops. (3 methods)

6. Study of Toposheets and Interpretation, Extraction of Drainage Basin and its Morphometric Analysis. (3Toposheets)

7. Interpretation and drawing of sections for geological maps showing tilted beds, faults, unconformities etc. (10 Maps)

8. Interpretation of Satellite Images. (2 Satellite images)

9. Field work– To identify Minerals, Rocks, Geomorphology and Structural features with related to the Civil Engineering projects.

Course outcomes: During this course, students will develop expertise in;

1. The students able to identify the minerals, rocks and utilize them effectively in civil engineering practices.
2. The students will interpret and understand the geological conditions of the area for implementation of civil engineering projects.
3. The students will interpret subsurface information such as thickness of soil, weathered zone, depth of hard rock and saturated zone by using geophysical methods.
4. The students will learn the techniques in the interpretation of LANDSAT Imageries to find out the lineaments and other structural features for the given area.
5. The students will be able to identify the different structures in the field.

Reference Books:

1. MP Billings, Structural Geology, CBS Publishers and Distributors, New Delhi.
2. B.S. Satyanarayana Swamy, Engineering Geology Laboratory Manual, Dhanpat Rai Sons, New Delhi.
3. LRA Narayan, remote sensing and its applications, UniversityPress.
4. P.K.MUKERJEE, Textbook of Geology, WorldPress Pvt. Ltd., Kolkatta
5. JohnI Plattand John Challinor, Simple Geological Structures,ThomasMurthy&Co, London.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

FLUID MECHANICS AND HYDRAULIC MACHINES LABORATORY

Course Code	**18CVL48**	CIE Marks	40
Teaching ours/Week(L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives: This course will enable students to;

1. calibrate flow measuring devices
2. determine the force exerted by jet of water on vanes
3. measure discharge and head losses in pipes
4. understand the fluid flow pattern

Experiments:

1. Verification of Bernoulli's equation.
2. Determination of Cd for Venturimeter and Orifice meter.
3. Determination of hydraulic coefficients of small vertical orifice.
4. Determination of C_d for Rectangular and Triangular notch
5. Determination of C_d for Ogee and Broad crested weir
6. Determination of C_d for Venturiflume
7. Determination of force exerted by a jet on flat and curved vanes.
8. Determination of efficiency of Pelton wheel turbine
9. Determination of efficiency of Francis turbine
10. Determination of efficiency of Kaplan turbine
11. Determination of efficiency of centrifugal pump
12. Determination of Major Loss in Pipes
13. Determination of Minor losses in pipe due to sudden enlargement, sudden contraction and bend.

Course outcomes: During the course of study students will develop understanding of:

1. Properties of fluids and the use of various instruments for fluid flow measurement.
2. Working of hydraulic machines under various conditions of working and their characteristics.

- All experiments are to be included in the examination except demonstration exercises.
- Candidate to perform experiment assigned to him.
- Marks are to be allotted as per the split up of marks shown on the cover page of answer script.

Reference Books:

1. Sarbjit Singh , Experiments in Fluid Mechanics - PHI Pvt. Ltd.- New Delhi
2. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press
3. Hydraulics and Fluid Mechanics' – Dr. P.N. Modi& D r S.M. Seth, Standard Book House- New Delhi. 2009Edition

B. E. CIVIL ENGINEERING Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER - IV			
ADDITIONAL MATHEMATICS – II (Mandatory Learning Course: Common to All Branches) (A Bridge course for Lateral Entry students under Diploma quota to BE/B. Tech programmes)			
Course Code	**18MATDIP41**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:1:0)	SEE Marks	60
Credits	00	Exam Hours	03

Course Learning Objectives:

- To provide essential concepts of linear algebra, second & higher order differential equations along with methods to solve them.
- To provide an insight into elementary probability theory and numerical methods.

Module-1

Linear Algebra: Introduction - rank of matrix by elementary row operations - Echelon form. Consistency of system of linear equations - Gauss elimination method. Eigen values and Eigen vectors of a square matrix. Problems.

Module-2

Numerical Methods: Finite differences. Interpolation/extrapolation using Newton's forward and backward difference formulae (Statements only)-problems. Solution of polynomial and transcendental equations – Newton-Raphson and Regula-Falsi methods (only formulae)- Illustrative examples. Numerical integration: Simpson's one

Module-3

Higher order ODE's: Linear differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators.[Particular Integral restricted to $R(x) = e^{ax}, \frac{sinax}{cosax}, x^n \; for \; f(D)y = R(x)$.

Module-4

Partial Differential Equations (PDE's): Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivative with respect to one independent variable only.

Module-5

Probability: Introduction. Sample space and events. Axioms of probability. Addition & multiplication theorems. Conditional probability, Bayes's theorem, problems.

Course Outcomes: At the end of the course the student will be able to:

- Solve systems of linear equations using matrix algebra.
- Apply the knowledge of numerical methods in modelling and solving of engineering problems.
- Apply the knowledge of numerical methods in modelling and solving of engineering problems.
- Classify partial differential equations and solve them by exact methods.
- Apply elementary probability theory and solve related problems.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook				
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	43rd Edition, 2015
Reference Books				

1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10th Edition, 2015
2	Engineering Mathematics Vol. I	Rohit Khurana	Cengage Learning	2015.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

CONSTRUCTION MANAGEMENT AND ENTREPRENEURSHIP

Course Code	**18CV51**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Understand the concept of planning, scheduling, cost and quality control, safety during construction, organization and use of project information necessary for construction project.
2. Inculcate Human values to grow as responsible human beings with proper personality.
3. Keep up ethical conduct and discharge professional duties.

Module -1

Management: Characteristics of management, functions of management, importance and purpose of planning process, types of plans.

Construction Project Formulation: Introduction to construction management, project organization, management functions, management styles.

Construction Planning and Scheduling: Introduction, types of project plans, work breakdown structure, Grant Chart, preparation of network diagram- event and activity based and its critical path-critical path method, PERT method, concept of activity on arrow and activity on node.

Module -2

Resource Management: Basic concepts of resource management, class of lab our, Wages & statutory requirement, Labour Production rate or Productivity, Factors affecting labour output or productivity.

Construction Equipments: classification of construction equipment, estimation of productivity for: excavator, dozer, compactors, graders and dumpers. Estimation of ownership cost, operational and maintenance cost of construction equipments. Selection of construction equipment and basic concept on equipment maintenance

Materials: material management functions, inventory management.

Module -3

Construction Quality , safety and Human Values:

Construction quality process, inspection, quality control and quality assurance, cost of quality, ISO standards. Introduction to concept of Total Quality Management

HSE: Introduction to concepts of HSE as applicable to Construction. Importance of safety in construction , Safety measures to be taken during Excavation , Explosives , drilling and blasting , hot bituminous works , scaffolds / platforms / ladder , form work and equipment operation. Storage of materials. Safety through legislation, safety campaign. Insurances.

Ethics : Morals, values and ethics, integrity, trustworthiness , work ethics, need of engineering ethics, Professional Duties, Professional and Individual Rights, Confidential and Proprietary Information, Conflict of Interest Confidentiality, Gifts and Bribes, Price Fixing, Whistle Blowing.

Module -4

Introduction to engineering economy: Principles of engineering economics, concept on Micro and macro analysis, problem solving and decision making.

Interest and time value of money: concept of simple and compound interest, interest formula for: single payment, equal payment and uniform gradient series. Nominal and effective interest rates, deferred annuities, capitalized cost.

Comparison of alternatives: Present worth, annual equivalent, capitalized and rate of return methods, Minimum Cost analysis and break even analysis.

Module -5

Entrepreneurship: Evolution of the concept, functions of an entrepreneur, concepts of entrepreneurship, stages in entrepreneurial process, different sources of finance for entrepreneur, central and state level financial institutions.

Micro, Small & Medium Enterprises (MSME): definition, characteristics, objectives, scope, role of MSME in economic development, advantages of MSME, Introduction to different schemes: TECKSOK, KIADB, KSSIDC, DIC, Single Window Agency: SISI, NSIC, SIDBI, KSFC.

Business Planning Process: Business planning process, marketing plan, financial plan, project report and feasibility study, guidelines for preparation of model project report for starting a new venture. Introduction to international entrepreneurship opportunities, entry into international business, exporting, direct foreign investment, venture capital.

Course Outcomes: After studying this course, students will be able to:

1. Prepare a project plan based on requirements and prepare schedule of a project by understanding the activities and their sequence.
2. Understand labour output, equipment efficiency to allocate resources required for an activity / project to achieve desired quality and safety.
3. Analyze the economics of alternatives and evaluate benefits and profits of a construction activity based on monetary value and time value.
4. Establish as an ethical entrepreneur and establish an enterprise utilizing the provisions offered by the federal agencies.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. P C Tripathi and P N Reddy, "Principles of Management", Tata McGraw-Hill Education
2. Chitkara, K.K, "Construction Project Management: Planning Scheduling and Control", Tata McGraw-Hill Publishing Company, New Delhi.
3. Poornima M. Charantimath , "Entrepreneurship Development and Small Business Enterprise", Dorling Kindersley (India) Pvt. Ltd., Licensees of PearsonEducation
4. Dr. U.K. Shrivastava "Construction Planning and Management", Galgotia publications Pvt. Ltd. New Delhi.
5. Bureau of Indian standards – IS 7272 (Part-1)- 1974 : Recommendations for labour output constant for building works:

Reference Books:

1. Robert L Peurifoy, Clifford J. Schexnayder, AviadShapira, Robert Schmitt, "Construction Planning, Equipment, and Methods (Civil Engineering), McGraw-HillEducation
2. Harold Koontz, Heinz Weihrich, "Essentials of Management: An International, Innovation, and Leadership perspective", T.M.H. Edition, NewDelhi
3. Frank Harris, Ronald McCaffer with Francis Edum-Fotwe, " Modern Construction Management", Wiley-Blackwell
4. Mike Martin, Roland Schinzinger, "Ethics in Engineering", McGraw-HillEducation
5. Chris Hendrickson and Tung Au, "Project Management for Construction - Fundamentals Concepts for Owners, Engineers, Architects and Builders", Prentice Hall,Pitsburgh
6. James L.Riggs, David D. Bedworth , Sabah U. Randhawa " Engineerng Economics" 4

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

ANALYSIS OF INDETERMINATE STRUCTURES

Course Code	**18CV52**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives: This course will enable students to
1. Apply knowledge of mathematics and engineering in calculating slope, deflection, bending moment and shear force using slope deflection, moment distribution method and Kani's method.
2. Identify, formulate and solve problems in structural analysis.
3. Analyze structural system and interpret data.
4. use the techniques, such as stiffness and flexibility methods to solve engineering problems
5. communicate effectively in design of structural elements

Module-1

Slope Deflection Method: Introduction, sign convention, development of slope deflection equation, analysis of continuous beams including settlements, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy≤3.

Module-2

Moment Distribution Method: Introduction, Definition of terms, Development of method, Analysis of continuous beams with support yielding, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy ≤3.

Module-3

Kani's Method: Introduction, Concept, Relationships between bending momentand deformations, Analysis of continuous beams with and without settlements, Analysis of frames with and without sway.

Module-4

Matrix Method of Analysis (Flexibility Method) : Introduction, Axes and coordinates, Flexibility matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with static indeterminacy ≤3.

Module-5

Matrix Method of Analysis (Stiffness Method): Introduction, Stiffness matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with kinematic indeterminacy ≤3.

Course Outcomes: After studying this course, students will be able to:
1. Determine the moment in indeterminate beams and frames having variable moment of inertia and subsidence using slope defection method
2. Determine the moment in indeterminate beams and frames of no sway and sway using moment distribution method.
3. Construct the bending moment diagram for beams and frames by Kani's method.
4. Construct the bending moment diagram for beams and frames using flexibility method
5. Analyze the beams and indeterminate frames by system stiffness method.

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:
1. Hibbeler R C, **" Structural Analysis",** Pearson Publication
2. L S Negi and R S Jangid, **"Structural Analysis",** Tata *McGraw-Hill* Publishing Company Ltd.
3. D S PrakashRao, **"Structural Analysis: A Unified Approach"** , Universities Press
4. K.U. Muthu, H. Narendraetal, **"Indeterminate Structural Analysis",** IK International Publishing Pvt. Ltd.

Reference Books:

1. Reddy C S, **"Basic Structural Analysis",**Tata McGraw-Hill Publishing Company Ltd.
2. Gupta S P, G S Pundit and R Gupta, **"Theory of Structures"**, Vol II, Tata McGraw Hill Publications company Ltd.
3. V N Vazirani and M MRatwani, **"Analysis Of Structures** ", Vol. 2, Khanna Publishers
4. Wang C K, **"Intermediate Structural Analysis",** McGraw Hill, International Students Edition.
5. S.Rajasekaran and G. Sankarasubramanian, **"Computational Structural Mechanics",** PHI Learning Pvt. Ltd.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

DESIGN OF RC STRUCTURAL ELEMENTS

Course Code	**18CV53**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Identify, formulate and solve engineering problems of RC elements subjected to different kinds of loading.
2. Follow a procedural knowledge in designing various structural RC elements.
3. Impart the usage of codes for strength, serviceability and durability.
4. Provide knowledge in analysis and design of RC elements.

Module-1

Introduction to working stress and limit State Design: Introduction to working stress method, Difference between Working stress and Limit State Method of design, Modular Ratio and Factor of Safety and evaluation of design constants for working stress method.
Philosophy and principle of limit state design with assumptions. Partial Safety factors, Characteristic load and strength. Stress block parameters, concept of balanced section, under reinforced and over reinforced section.
Limiting deflection, short term deflection, long term deflection, Calculation of deflection of singly reinforced beam only. Cracking in reinforced concrete members, calculation of crack width of singly reinforced beam. Side face reinforcement, slender limits of beams for stability.

Module-2

Limit State Analysis of Beams:
Analysis of singly reinforced, doubly reinforced and flanged beams for flexure and shear.

Module-3

Limit State Design of Beams: Design of singly and doubly reinforced beams, Design of flanged beams, design for combined bending, shear and torsion as per IS-456.

Module-4

Limit State Design of Slabs and Stairs: Introduction to one way and two way slabs, Design of cantilever, simply supported and one way continuous slab. Design of two way slabs for different boundary conditions. Design of dog legged and open well staircases. Importance of bond, anchorage length and lap length.

Module-5

Limit State Deign of Columns and Footings: Analysis and design of short axially loaded RC column. Design of columns with uniaxial and biaxial moments, Design concepts of the footings. Design of Rectangular and square column footings with axial load and also for axial load & moment.

Course outcomes: After studying this course, students will be able to:

1. Understand the design philosophy and principles.
2. Solve engineering problems of RC elements subjected to flexure, shear and torsion.
3. Demonstrate the procedural knowledge in designs of RC structural elements such as slabs, columns and footings.
4. Owns professional and ethical responsibility.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

- The designs are as per IS-456 and SP (16) relevant charts to be provided in the question paper.

Textbooks:

1. Unnikrishnan Pillai and Devdas Menon, " **Reinforced Concrete Design"** , McGraw Hill, New Delhi
2. Subramanian, " **Design of Concrete Structures"** , Oxford university Press
3. H J Shah, **"Reinforced Concrete Vol. 1 (Elementary Reinforced Concrete)"** , Charotar Publishing House Pvt. Ltd.

Reference Books:

1. P C Varghese, “Limit State design of reinforced concrete” , PHI, New Delhi.
2. W H Mosley, R Husle, J H Bungey, “Reinforced Concrete Design”, MacMillan Education, Palgrave publishers.
3. Kong and Evans, “Reinforced and Pre-Stressed Concrete”, Springer Publications.
4. A W Beeby and Narayan R S, “Introduction to Design for Civil Engineers”, CRC Press.
5. Robert Park and Thomas Paulay, “Reinforced Concrete Structures”, John Wiley & Sons, Inc.

B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - V			
BASIC GEOTECHNICAL ENGINEERING			
Course Code	**18CV54**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Appreciate basic concepts of soil mechanics as an integral part in the knowledge of civil engineering.
2. Comprehend basic engineering and mechanical properties of different types of soil.
3. Become broadly familiar with geotechnical engineering problems such as, flow of water through soil medium and terminologies associated with geotechnical engineering.
4. Assessthe improvementin mechanical behaviour by densification of soil deposits using compaction.
5. Model and measure strength-deformation characteristics of soils.

Module-1

Introduction: Origin and formation of soil, Regional soil deposits in India, Phase Diagram, phase relationships, definitions and their interrelationships.
Determination of Index properties: Specific gravity, water content, in-situ density, relative density, particle size analysis(sieve and Hydrometer analysis)
Atterberg's Limits, consistency indices. Activity of clay, Field identification tests, Plasticity chart, BIS soil classification (IS: 1498-1970).

Module-2

Soil Structure and Clay Mineralogy Single grained, honey combed, flocculent and dispersed structures, Valence bonds, Soil-Water system, Electrical diffuse double layer, adsorbed water, base-exchange capacity, Isomorphous substitution. Common clay minerals in soil and their structures- Kaolinite, Illite and Montmorillonite and their application in Engineering
Compaction of Soils: Definition, Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control-compactive effort & method of compaction, lift thickness and number of passes, Proctor's needle, Compacting equipments and their suitability.

Module -3

Flow through Soils: Darcy's law-assumption and validity, coefficient of permeability and its determination (laboratory and field), factors affecting permeability, permeability of stratified soils, Seepage velocity, superficial velocity and coefficient of percolation, Capillary Phenomena.
Seepage Analysis: Laplace equation, assumptions, limitation sand its derivation. Flow nets-characteristics and applications. Flow nets for sheet piles and below the dam section.
Unconfined flow, phreaticline (Casagrande's method–with and without toe filter), flow through dams, design of dam filters.
Effective Stress Analysis:
Geostatic stresses, Effective stress concept-total stress, effective stress and Neutral stress and impact of the effective stress in construction of structures, quick sand phenomena.

Module -4

Shear Strength of Soil: Concept of shear strength, Mohr–Coulomb Failure Criterion, Modified Mohr–Coulomb Criterion Total and effective shear strength parameters, factors affecting shear strength of soils. Thixotrophy and sensitivity, Measurement of shear strength parameters - Direct shear test, unconfined compression test, triaxial compression test and field Vane shear test, Test under different drainage conditions.

Module-5

Consolidation of Soil: Definition, Mass-spring analogy, Terzaghi's one dimensional consolidationtheory-assumptionsandlimitations.GoverningdifferentialEquation and solution (No derivation).
Consolidation characteristics of soil (C_C, a_V, m_V and C_V). Laboratory one dimensional consolidation test, characteristics of e-log (σ') curve, Pre-consolidation pressure and its determination by Casagrande's method. Over consolidation ratio, normally consolidated, under consolidated and over consolidated soils.

Determination of consolidation characteristics of soils- compression index and coefficient of consolidation (square root of time fitting method, logarithmic time fitting method). Primary and secondary consolidation.

Course outcomes: On the completion of this course students are expected to attain the following outcomes;

1. Ability to plan and execute geotechnical site investigation program for different civil engineering projects
2. Understanding of stress distribution and resulting settlement beneath the loaded footings on sand and clayey soils
3. Ability to estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures
4. Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure
5. Capable of estimating load carrying capacity of single and group of piles

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Gopal Ranjan and Rao A.S.R., Basic and Applied Soil Mechanics, New Age International (P) Ltd., New Delhi.
2. Punmia B C, Soil Mechanics and Foundation Engineering, Laxmi Publications co., New Delhi.
3. Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering, UBS Publishers and Distributors, New Delhi.
4. Braja, M. Das, Geotechnical Engineering; Thomson Business Information India (P) Ltd., India.

Reference Books:

1. T.W. Lambe and R.V. Whitman, Soil Mechanics-, John Wiley & Sons.
2. Donald P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi.
3. Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering-. , Tata McGraw Hill Publications.
4. Debashis Moitra, “Geotechnical Engineering”, Universities Press.,
5. Malcolm D Bolton, “A Guide to soil mechanics”, Universities Press.,
6. Bowles J E , Foundation analysis and design, McGraw- Hill Publications.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS)and Outcome Based Education (OBE)
SEMESTER - V

MUNICIPAL WASTEWATER ENGINEERING

Course Code	**18CV55**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to;
1. Understand the various water demands and population forecasting methods.
2. Understand and design different unit operations and unit process in involved in wastewater treatment process
3.Understand the concept and design of various physicochemical treatment units
4. Understand the concept and design of various biological treatment units
5. Understand the concept of various advance waste water and low cost treatment processes for rural areas.

Module-1

Introduction: Need for sanitation, methods of sewage disposal, types of sewerage systems, dry weather flow, wet weather flow, factors effecting dry and wet weather flow on design of sewerage system, estimation of storm water flow, time of concentration flow, numericals.
Sewer appurtenances: Manholes, catch basins, oil and grease traps. P, Q and S traps. Material of sewers, shape of sewers, laying and testing of sewers, ventilation of sewers basic principles of house drainage.

Module-2

Design of sewers: Hydraulic formula to determine velocity and discharge. Self cleansing and non scouring velocity. Design of hydraulic elements for circular sewers for full flow and half flow conditions.
Waste water characteristics: sampling, significance and techniques, physical, chemical and biological characteristics, flow diagram for municipal waste water
Treatment unit operations and process. Estimation of BOD. Reaction kinetics (zero order, 1st order and 2nd order).

Module-3

Treatment of municipal waste water: Screens: types, disposal. Grit chamber, oil and grease removal. primary and secondary settling tanks.
Disposal of effluents: Dilution, self-purification phenomenon, oxygen sag curve, zones of purification, sewage farming, sewage sickness, numerical problems on disposal of effluents. Streeter-Phelps equation.

Module-4

Biological Treatment Process: Suspended growth system - conventional activated sludge process and its modifications. Attached growth system – trickling filter, bio-towers and rotating biological contactors.
Principle of stabilization ponds, oxidation ditch, Sludge digesters(aerobic and anaerobic), Equalization., thickeners and drying beds.

Module-5

Advanced Wastewater Treatment: Need and technologies used. Nitrification and Denitrification Processes, Phosphorous removal. Advance oxidation processes (AOPs), Electro coagulation.
Rural sanitation: Low cost treatment process: Working principal and design of septic tanks for small community in rural and urban areas, two-pit latrines, eco-toilet and soak pits.

Course outcomes: After studying this course, the students will be able to:
1. Select the appropriate sewer appurtenances and materials in sewer network.
2. Design the sewers network and understand the self purification process in flowing water.
3.Deisgn the varies physic- chemical treatment units
4. Design the various biological treatment units
5. Design various AOPs and low cost treatment units.

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks

1. Howard S. Peavy, Donald R. Rowe, George T, "Environmental Engineering" - Tata McGraw Hill, New York, Indian Edition, 2013
2. B C Punmia, "Environmental Engineering vol-II", Laxmi Publications 2^{nd}, 2016
3. Karia G.L., and Christian R.A, "Wastewater Treatment Concepts and Design Approach", Prentice Hall of India Pvt. Ltd., New Delhi. $3^{rd,}$ Edition, 2017
4. S.K.Garg, "Environmental Engineering vol-II, Water supply Engineering", Khanna Publishers, – New Delhi, 28^{th} edition and 2017

Reference Books

1. CPHEEO manual on sewage treatment, Ministry of Urban Development, Government of India, New Delhi,1999
2. Mark.J Hammer, "Water & Waste Water Technology" John Wiley & Sons Inc., New York, 2008
3. Benefield R.D., and Randal C.W, "Biological Process Design for Wastewater Treatment", Prentice Hall, Englewood Chiffs, New Jersey 2012
4. Metcalf and Eddy Inc, "Wastewater Engineering - Treatment and Reuse", Publishing Co. Ltd., New Delhi, 4th Edition, 2009.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

HIGHWAY ENGINEERING

Course Code	**18CV56**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to;

1. Gain knowledge of different modes of transportation systems, history, development of highways and the organizations associated with research and development of the same in INDIA.
2. Understand Highway planning and development considering the essential criteria's (engineering and financial aspects, regulations and policies, socio economic impact).
3. Get insight to different aspects of geometric elements and train them to design geometric elements of a highway network.
4. Understand pavement and its components, pavement construction activities and its requirements.
5. Gain the skills of evaluating the highway economics by B/C, NPV, IRR methods and also introduce the students to highway financing concepts.

Module -1

Principles of Transportation Engineering: Importance of transportation, Different modes of transportation and comparison, Characteristics of road transport Jayakar committee recommendations, and implementation – Central Road Fund, Indian Roads Congress, Central Road Research Institute.

Highway Development and Planning: Road types and classification, road patterns, planning surveys, master plan – saturation system of road planning, phasing road development in India, problems on best alignment among alternate proposals Salient Features of 3rd and 4thtwenty year road development plans and Policies, Present scenario of road development in India (NHDP & PMGSY) and in Karnataka (KSHIP & KRDCL) Road development plan - vision 2021.

Highway Alignment and Surveys: Ideal Alignment, Factors affecting the alignment, Engineering surveys-Map study, Reconnaissance, Preliminary and Final location & detailed survey, Reports and drawings for new and re-aligned projects.

Module -2

Highway Geometric Design of horizontal alignment elements: Cross sectional elements–width, surface, camber, Sight distances–SSD, OSD, ISD, HSD, Radius of curve, Transition curve, Design of horizontal and vertical alignment–curves, super-elevation, widening, gradients, summit and valley curves.

Module -3

Pavement Materials: Sub grade soil - desirable properties-HRB soil classification-determination of CBR and modulus of sub grade reaction with Problems Aggregates- Desirable properties and tests, Bituminous materials- Explanation on Tar, bitumen, cutback and emulsion-tests on bituminous material Pavement Design: Pavement types, component parts of flexible and rigid pavements and their functions, ESWL and its determination (Graphical method only)-Examples.

Module -4

Pavement Construction: Design of soil aggregate mixes by Rothfuch's method. Uses and properties of bituminous mixes and cement concrete in pavement construction. Earthwork; cutting and Filling, Preparation of subgrade, Specification and construction of i) Granular Sub base, ii) WBM Base iii) WMM base,iv) Bituminous Macadam v) Dense Bituminous Macadam vi) Bituminous Concrete,vii) Dry Lean Concrete sub base and PQC viii) concrete roads.

Module -5

Highway Drainage: Significance and requirements, Surface drainage system and design-Examples, sub surface drainage system, design of filter materials, Types of cross drainage structures, their choice and location.

Highway Economics: Highway user benefits, VOC using charts only-Examples, Economic analysis - annual cost method-Benefit Cost Ratio method-NPV-IRR methods- Examples, Highway financing-BOT-BOOT concepts.

Course Outcomes: After studying this course, students will be able to:

1. Acquire the capability of proposing a new alignment or re-alignment of existing roads, conduct necessary field investigation for generation of required data.
2. Evaluate the engineering properties of the materials and suggest the suitability of the same for pavement construction.
3. Design road geometrics, structural components of pavement and drainage.
4. Evaluate the highway economics by few select methods and also will have a basic knowledge of various highway financing concepts.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. S K Khanna and C E G Justo, "Highway Engineering", Nem Chand Bros, Roorkee.
2. L R Kadiyali, "Highway Engineering", Khanna Publishers, New Delhi.
3. R Srinivasa Kumar, "Highway Engineering", University Press.
4. K. P.Subramanium, "Transportation Engineering", SciTech Publications, Chennai.

Reference Books:

1. Relevant IRC Codes.
2. Specifications for Roads and Bridges-MoR T&H, IRC, New Delhi.
3. C. JotinKhisty, B. Kentlal, "Transportation Engineering", PHI Learning Pvt. Ltd. New Delhi.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

SURVEYING PRACTICE

Course Code	**18CVL57**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Apply the basic principles of engineering surveying and measurements
2. Followeffectivelyfieldproceduresrequiredforaprofessionalsurveyor
3. Use techniques, skills and conventional surveying instruments necessary for engineering practice.

1. a) Measurements of distances using tape along with horizontal planes and slopes, direct ranging.
   b) Setting out perpendiculars. Use of cross staff, optical square.
2. Measurements of bearings / directions using prismatic compass, setting of geometrical figures using prismatic compass.
3. Determination of distance between two inaccessible points using compass and
4. Determination of reduced levels of points using dumpy level/auto level (simple
5. Determination of reduced levels of points using dumpy level/auto level (differential leveling and inverted leveling).
6. To determine the difference in elevation between two points using Reciprocal leveling and to determine the collimation error.
7. To conduct profile leveling, cross sectioning and block leveling. Plotting profile and cross sectioning in excel. Block contour on graph paper to scale.
8. Measurement of horizontal angle by repetition and reiteration methods and Measurement of vertical angles using theodolite.
9. Determination of horizontal distance and vertical height to a base in accessible object using theodolite by single plane and double plane method.
10. To determine distance and elevation using tachometric surveying with horizontal and inclined line of sight.
11. Closed traverse surveying using Theodolite and applying corrections for error of closure by transit rule and Bowditch rule.
12. To locate the points using Radiation and Intersection method of Plane table surveying.
13. To solve three point problem in plane table using Bessel's graphical solution.
14. DemonstrationofMinorinstrumentslikeClinometer,CeylonGhattracer,Boxsextant,Hand level, Planimeter, nautical extant and Penta graph.

Course Outcomes: After a successful completion of the course, the student will be able to:

1. Apply the basic principles of engineering surveying and for linear and angular measurements.
2. Comprehendeffectivelyfieldproceduresrequiredforaprofessionalsurveyor.
3. Use techniques, skills and conventional surveying instruments necessary for engineering practice.

Question paper pattern:

- All are individual experiments.
- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.
- All exercises are to be included for practical examination.

Textbooks:

1. B.C.Punmia,"SurveyingVol.1",LaxmiPublicationspvt.Ltd.,NewDelhi– 2009.
2. Kanetkar T P and S V Kulkarni, Surveying and Levelling Part I, Pune Vidyarthi Griha Prakashan, 1988.

Reference Books:
1. S. K. Duggal, “SurveyingVol.1”,Tata Mc Graw Hill Publishing Co. Ltd. New Delhi. 2009. 2. K.R.Arora, “SurveyingVol.1” Standard Book House, New Delhi.–2010.

B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - V			
CONCRETE AND HIGHWAY MATERIALS LABORATORY			
Course Code	**18CVL58**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives: This course will enable students

1. To learn the procedure of testing concrete ingredients and properties of concrete as per standard code recommendations.
2. To learn the procedure of testing bituminous materials as per standard code recommendations.
3. To relate material characteristics to various application of construction.

Modules

Part A: Concrete Lab

1. Tests on Cement:
   a. Normal Consistency
   b. Setting time
   c. Compressive strength
   d. fineness by air permeability test
   e. specific gravity
2. Tests on Concrete:
   a. Design of concrete mix as perIS-10262
   b. Tests on fresh concrete:
      i. slump,
      ii. compaction factor and
      iii. Vee Bee test
   c. Tests on hardened concrete:
      i. compressive strength test,
      ii. split tensile strength test,
      iii. flexural strength test
   d. NDT tests by re bound hammer and pulse velocity test.
3. Tests on Self Compacting Concrete:
   a. Design of self compacting concrete, As per Is 10262:2019
   b. slump flow test,
   c. V-funnel test,
   d. J-Ring test,
   e. U Box test and
   f. L Box test

Part B: Highway materials Lab

1. Tests on Aggregates
   a. Aggregate Crushing value
   b. Los Angeles abrasion test
   c. Aggregate impact test
   d. Aggregate shape tests(combined index and angularity number)
2. Tests on Bituminous Materials
   a. Penetration test
   b. Ductility test
   c. Softening point test
   d. Specific gravity test
   e. Viscosity test by tarviscometer
   f. Bituminous Mix Design by Marshal Method (Demonstration only)
3. Tests on Soil
   a. Wet sieve analysis
   b. CBR test

Course Outcomes: During this course, students will develop expertise in

1. Able to interpret the experimental results of concrete and highway materials based on laboratory tests.
2. Determine the quality and suitability of cement.
3. Design appropriate concrete mix Using Professional codes.
4. Determine strength and quality of concrete.
5. Evaluate the strength of structural elements using NDT techniques.
6. Test the soil for its suitability as sub grade soil for pavements.

Question paper pattern:

- All are individual experiments
- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.
- All exercises are to be included for practical examination.

Reference Books:

1. M. L. Gambir, "Concrete Manual", Danpat Rai and sons, New Delhi
2. Shetty M.S, "Concrete Technology", S. Chand &Co. Ltd, New Delhi.
3. Mehta P.K, "Properties of Concrete", Tata McGraw Hill Publications, New Delhi.
4. Neville AM, "Properties of Concrete", ELBS Publications, London.
5. Relevant BIS codes.
6. S K Khanna, C E G Justo and A Veeraragavan, "Highway Materials Testing Laboratory Manual", Nem Chand Bros, Roorkee.
7. L R Kadiyali, "Highway Engineering", Khanna Publishers, New Delhi.

B.E IN CIVIL ENGINEERING(CV-2018-19)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – V

ENVIRONMENTAL STUDIES

Course Code	**18CIV59**	CIE Marks	40
Teaching Hours / Week (L:T:P)	(1:0:0)	SEE Marks	60
Credits	01	Exam Hours	02

Module - 1

Ecosystems (Structure and Function): Forest, Desert, Wetlands, Riverine, Oceanic and Lake.
Biodiversity: Types, Value; Hot-spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.

Module - 2

Advances in Energy Systems (Merits, Demerits, Global Status and Applications)**:** Hydrogen, Solar, OTEC, Tidal and Wind.
Natural Resource Management (Concept and case-studies): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading.

Module - 3

Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies)**:** Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution.
Waste Management & Public Health Aspects: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.

Module - 4

Global Environmental Concerns (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.

Module - 5

Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications): G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship- NGOs.
Field work: Visit to an Environmental Engineering Laboratory or Green Building or Water Treatment Plant or Waste water treatment Plant; ought to be Followed by understanding of process and its brief documentation.

Course outcomes: At the end of the course, students will be able to:

- CO1: Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale,
- CO2: Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
- CO3: Demonstrate ecology knowledge of a complex relationship between biotic and a biotic components.
- CO4: Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.

Question paper pattern:

- The Question paper will have 100 objective questions.
- Each question will be for 01 marks
- Student will have to answer all the questions in an OMR Sheet.
- The Duration of Exam will be 2 hours.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Environmental Studies	Benny Joseph	Tata Mc Graw – Hill.	2nd Edition, 2012

2.	Environmental Studies	S M Prakash	Pristine Publishing House, Mangalore	3rd Edition, 2018
3	Environmental Studies – From Crisis to Cure	R Rajagopalan	Oxford Publisher	2005
Reference Books				
1	Principals of Environmental Science and Engineering	Raman Sivakumar	Cengage learning, Singapur.	2nd Edition, 2005
2	Environmental Science – working with the Earth	G.Tyler Miller Jr.	Thomson Brooks /Cole,	11th Edition, 2006
3	Text Book of Environmental and Ecology	Pratiba Sing, AnoopSingh& PiyushMalaviya	Acme Learning Pvt. Ltd. New Delhi.	1st Edition

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

DESIGN OF STEEL STRUCTURAL ELEMENTS

Course Code	**18CV61**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives: This course will enable students to
1. Understand advantages and disadvantages of steel structures, steel code provisions, and plastic behaviour of structural steel.
2. Learn Bolted connections and Welded connections.
3. Design of compression members, built-up columns and columns splices.
4. Design of tension members, simple slab base and gusseted base.
5. Design of laterally supported and un-supported steel beams.

Module -1

Introduction: Advantages and Disadvantages of Steel Structures, Limit state method Limit State of Strength, Structural Stability, Serviceability Limit states, Failure Criteria of steel, Design Consideration, Loading and load combinations, IS code provisions, Specification and Section classification.

Plastic Behavior of Structural Steel: Introduction, Plastic theory, Plastic Hinge Concept, Plastic collapse load, load factor, Shape factor, Theorem of plastic collapse, Methods of Plastic analysis, Plastic analysis of Continuous Beams.

Module -2

Bolted Connections: Introduction, Types of Bolts, Behavior of bolted joints, Design of High Strength friction Grip (HSFG) bolts, Design of Simple bolted Connections (Lap and Butt joints)and bracket connections.

Welded Connections: Introduction, Types and properties of welds, Effective areas of welds, Weld Defects, Simple welded joints for truss member and bracket connections, Advantages and Disadvantages of Bolted and Welded Connections.

Module -3

Design of Compression Members: Introduction, Failure modes, Behavior of compression members, Sections used for compression members, Effective length of compression members, Design of compression members and built up Compression members, Design of Laced and Battened Systems.

Module -4

Design of Tension Members: Introduction, Types of Tension members, Slenderness ratio, Modes of Failure, Factors affecting the strength of tension members, Design of Tension members and Lug angles, Splices, Gussets.

Design of Column Bases: Design of Simple Slab Base and Gusseted Base.

Module -5

Design of Beams: Introduction, Beam types, Lateral Stability of beams, factors affecting lateral stability, Behavior of Beams in Bending, Design strength of laterally supported beams in Bending, Design of Laterally unsupported Beams [No Numerical Problems], Shear Strength of Steel Beams.

Beam to Beam Connections, Beam to Column Connection and Column Splices [No Numerical Problems].

Course Outcomes: After studying this course, students will be able to:
1. Possess knowledge of Steel Structures Advantages and Disadvantages of Steel structures, steel code provisions and plastic behaviour of structural steel.
2. Understand the Concept of Bolted and Welded connections.
3. Understand the Concept of Design of compression members, built-up columns and columns splices.
4. Understand the Concept of Design of tension members, simple slab base and gusseted base.
5. Understand the Concept of Design of laterally supported and un-supported steel beams.

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.

- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. N Subramanian., "Design of Steel Structures" (2016), Oxford University Press, New Delhi.
2. Duggal S K., "Limit State Method of Design of Steel Structures", Tata McGraw Hill, New Delhi.

Reference Books:

1. Dayarathnam P, "Design of Steel Structures", Scientific International Pvt. Ltd.
2. Kazim S M A and Jindal R S, "Design of Steel Structures", Prentice Hall of India, New Delhi.
3. IS 800-2007: General Construction in Steel Code Practice (Third revision), Bureau of Indian Standards, New Delhi.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

APPLIED GEOTECHNICAL ENGINEERING

Course Code	**18CV62**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Appreciate basic concepts of soil mechanics as an integral part in the knowledge of Civil Engineering. Also to become familiar with foundation engineering terminology and understand how the principles of Geo-technology are applied in the design of foundations
2. Learn introductory concepts of Geotechnical investigations required for civil engineering projects emphasizing in situ investigations
3. Conceptually learn various theories related to bearing capacity of soil and their application in the design of shallow foundations and estimation of load carrying capacity of pile foundation
4. Estimate internal stresses in the soil mass and application of this knowledge in proportioning of shallow and deep foundation fulfilling settlement criteria
5. Study about assessing stability of slopes and earth pressure on rigid retaining structures

Module-1

Soil Exploration: Introduction, Objectives and Importance, Stages and Methods of exploration- Test pits, Borings, Geophysical methods, stabilization of boreholes, Sampling techniques, Undisturbed, disturbed and representative samples, Geophysical exploration and Bore hole log. Drainage and Dewatering methods, estimation of depth of GWT (Hvorslev's method).

Module-2

Stress in Soils: Introduction, Boussinesq's and Westergaard's theory concentrated load, circular and rectangular load, equivalent point load method, pressure distribution diagrams and contact pressure, Newmark's chart.

Foundation Settlement: Types of settlements and importance, Computation of immediate and consolidation settlement, permissible differential and total settlements (IS 8009 part 1).

Module-3

Lateral Earth Pressure: Active, Passive and earth pressure at rest, Rankine's theory for cohesionless and cohesive soils, Coulomb's theory, Rebhann's and Culmann's graphical construction.

Stability of Slopes : Assumptions, infinite and finite slopes, factor of safety, Swedish slip circle method for C and C-ø (Method of slices) soils, Fellineous method for critical slip circle, use of Taylor's stability charts.

Module-4

Bearing Capacity of Shallow Foundation: Types of foundations, Determination of bearing capacity by Terzaghi's and BIS method (IS: 6403), Modes of shear failure, Factors affecting Bearing capacity of soil. Effect of water table and/or eccentricity on bearing capacity of soil, field methods of determining bearing capacity of soil: SPT and plate load test.

Module-5

Pile Foundations: Types and classification of piles, single loaded pile capacity in cohesionless and cohesive soils by static and Dynamic formulas, efficiency of Pile group, group capacity of piles in cohesionless and cohesive soils, negative skin friction, pile load tests, Settlement of piles, under reamed piles (only introductory concepts – no derivation).

Course outcomes: On the completion of this course students are expected to attain the following outcomes;

1. Ability to plan and execute geotechnical site investigation program for different civil engineering projects
2. Understanding of stress distribution and resulting settlement beneath the loaded footings on sand and clayey soils
3. Ability to estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures
4. Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure
5. Capable of estimating load carrying capacity of single and group of piles

Question paper pattern:

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering, UBS Publishers and Distributors, New Delhi.
2. K.R. Arora, Soil Mechanics and Foundation Engineering, Standard Publisher Distributors, New Delhi.
3. P C Varghese, Foundation Engineering, PHI India Learning Private Limited, New Delhi.
4. Punmia B C, Soil Mechanics and Foundation Engineering-(2017), 16thEdition, Laxmi Publications co., New Delhi.

Reference Books:

1. T.W. Lambe and R.V. Whitman, Soil Mechanics-, John Wiley & Sons.
2. Donald P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi.
3. Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering-. , Tata McGraw Hill Publications.
4. Debashis Moitra, “Geotechnical Engineering”, Universities Press.,
5. Malcolm D Bolton, “A Guide to soil mechanics”, Universities Press.,
6. Bowles J E , Foundation analysis and design, McGraw- Hill Publications.
7. Bureau of Indian Standards: IS-1904, IS-6403, IS-8009, IS-2950, IS-2911 and all other relevant codes.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

HYDROLOGY AND IRRIGATION ENGINEERING

Course Code	**18CV63**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Understand the concept of hydrology and components of hydrologic cycle such as precipitation, infiltration, evaporation and transpiration.
2. Quantify runoff and use concept of unit hydrograph.
3. Demonstrate different methods of irrigation, methods of application of water and irrigation procedure.
4. Design canals and canal network based on the water requirement of various crops.
5. Determine the reservoir capacity.

Module -1

Hydrology: Introduction, Importance of hydrology, Global distribution of water and Indian water availability, Practical application of hydrology, Hydrologic cycle (Horton's) qualitative and engineering representation.

Precipitation: Definition, Forms and types of precipitation, measurement of rain fall using Symon's and Syphon type of rain gauges, optimum number of rain gauge stations, consistency of rainfall data (double mass curve method), computation of mean rainfall, estimation of missing data, presentation of precipitation data, moving average curve, mass curve, rainfall hyetographs.

Module -2

Losses: Evaporation: Introduction, Process, factors affecting evaporation, measurement using IS class-A Pan, estimation using empirical formulae (Meyer's and Rohwer's equations) Reservoir evaporation and control.

Evapo-transpiration: Introduction, Consumptive use, AET, PET, Factors affecting, Measurement, Estimation by Blaney-Criddle equation.

Infiltration: Introduction, factors affecting infiltration capacity, measurement by double ring infiltrometer, Horton's infiltration equation, infiltration indices.

Module -3

Runoff: Definition, concept of catchment, factors affecting runoff, rainfall – runoff relationship using regression analysis.

Hydrographs: Definition, components of hydrograph, base flow separation, unit hydrograph, assumption, application and limitations, derivation from simple storm hydrographs, S curve and its computations, Conversion of UH of different durations.

Module -4

Irrigation: Definition. Benefits and ill effects of irrigation. System of irrigation: surface and ground water, flow irrigation, lift irrigation, Bandhara irrigation.

Water Requirements of Crops: Duty, delta and base period, relationship between them, factors affecting duty of water crops and crop seasons in India, irrigation efficiency, frequency of irrigation.

Module -5

Canals: Types of canals. Alignment of canals. Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor. Unlined and lined canals. Standard sections. Design of canals by Lacey's and Kennedy's method.

Reservoirs: Definition, investigation for reservoir site, storage zones determination of storage capacity using mass curves, economical height of dam.

Course outcomes: After studying this course, students will be able to:
1. Understand the importance of hydrology and its components.
2. Measure precipitation and analyze the data and analyze the losses in precipitation.
3. Estimate runoff and develop unit hydrographs.

4. Find the benefits and ill-effects of irrigation.
5. Find the quantity of irrigation water and frequency of irrigation for various crops.
6. Find the canal capacity, design the canal and compute the reservoir capacity.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. K. Subramanya, "Engineering Hydrology", Tata McGraw Hill Publishers, New Delhi.
2. Jayarami Reddy, "A Text Book of Hydrology", Lakshmi Publications, New Delhi.
3. Punmia and LalPandey, "Irrigation and Water Power Engineering" Lakshmi Publications, New Delhi.

Reference Books:

1. H.M. Raghunath, "Hydrology", Wiley Eastern Publication, New Delhi.
2. Sharma R.K., "Irrigation Engineering and Hydraulics", Oxford & IBH Publishing Co., New Delhi.
3. VenTe Chow, "Applied Hydrology", Tata McGraw Hill Publishers, New Delhi.
4. Modi P.N "Water Resources and Water Power Engineering"-. Standard book house, Delhi.
5. Garg S.K, "Irrigation Engineering and Hydraulic Structures" Khanna publications, New Delhi.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

MATRIX METHOD OF STRUCTURAL ANALYSIS

Course Code	**18CV641**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to
1. Gain basic knowledge of structural systems and application of concepts of flexibility and stiffness matrices for simple elements.
2. Understand flexibility and stiffness matrices to solve problems in beams, frames and trusses.
3. Gain knowledge of direct stiffness method to solve problems in beams, frames and trusses.
4. Gain knowledge of solving problems involving temperature changes and lack of fit.

Module -1

Introduction: Structural systems, geometric and material non-linearity, principle of superposition, equilibrium and compatibility conditions, static and kinematic indeterminacy, principle of minimum potential energy and minimum complementary energy, concepts of stiffness and flexibility, flexibility and stiffness matrices of beam and truss elements.

Module -2

Element Flexibility Method: Force transformation matrix, global flexibility matrix, analysis of continuous beams, rigid frames and trusses.

Module -3

Element Stiffness Method: Displacement transformation matrix, global stiffness matrix, analysis of continuous beams, rigid frames and trusses.

Module -4

Effects of Temperature Changes and Lack of Fit: Related numerical problems by flexibility and stiffness method as in Module 2 and Module 3.

Module -5

Direct Stiffness Method: Local and global coordinates systems, principle of contra gradience, global stiffness matrices of beam and truss elements, analysis of continuous beams and trusses.

Course Outcomes: After studying this course, students will be able to:
1. Evaluate the structural systems to application of concepts of flexibility and stiffness matrices for simple problems.
2. Identify, formulate and solve engineering problems with respect to flexibility and stiffness matrices as applied to continuous beams, rigid frames and trusses.
3. Identify, formulate and solve engineering problems by application of concepts of direct stiffness method as applied to continuous beams and trusses.
4. Evaluate secondary stresses.

Question paper pattern:
Question paper pattern:
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:
1. Weaver W and Gere J H, **"Matrix Analysis of Framed Structures"**, CBS publications, New Delhi.
2. Rajasekaran S, **"Computational Structural Mechanics"**, PHI, New Delhi.
3. Madhujit Mukhopadhay and Abdul Hamid Sheikh, **"Matrix and Finite Element Analysis of Structures"**, Ane Books Pvt. Ltd.

Reference Books:

1. Godbole P N et.al, “Matrix Method of Structural Analysis”, PHI ltd, New Delhi.
2. Pundit and Gupta, “Theory of Structures Vol II”, TMH publications, New Delhi
3. A K Jain, “Advanced Structural Analysis”, Nemchand Publications, Roorkee.
4. Manikaselvam, “Elements of Matrix Analysis and Stability of Structures”, Khanna Publishers, New Delhi.
5. H C Martin, “Introduction to Matrix Methods in Structural Analysis”, International textbook company, McGraw Hill.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

SOLID WASTE MANAGEMENT

Course Code	**18CV642**	CIE Marks	40
Teaching Hours/Week(L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Study the present methods of solid waste management system and to analyze their draw backs comparing with statutory rules.
2. Understand different elements of solid waste management from generation of solid waste to disposal.
3. Analyze different processing technologies and to study conversion of municipal solid waste to compost or biogas.
4. Evaluate landfill site and to study the sanitary landfill reactions.

Module -1

Sources: Sources of Solid waste, Types of solid waste, Physical and Chemical composition of municipal solid waste. Generation rate, Numerical Problems.
Collection: Collection of solid waste- services and systems, equipments,
Transportation: Need of transfer operation, transfer station, transport means and methods, route optimization. Solid waste management 2000 rules with, 2016 amendments.

Module -2

Processing techniques: Purpose of processing, Volume reduction by incineration, Process description, Mechanical volume reduction (compaction), Mechanical size reduction (shredding), component separation (manual and mechanical methods).

Module -3

Composting Aerobic and anaerobic method - process description, process microbiology, design consideration, Mechanical composting, Vermi composting, Numerical Problems.
Sanitary land filling: Definition, advantages and disadvantages, site selection, methods, reaction occurring in landfill- Gas and Leachate movement, Control of gas and leachate movement, Design of sanitary landfill. Numerical Problems.

Module -4

Sources, collection, treatment and disposal:- Biomedical waste,E-waste, construction and demolition waste.

Module -5

Incineration -3Ts factor affecting incineration, types of incinerations, Pyrolsis , Energy recovery technique from solid waste management. Hazardous waste.

Course outcomes: After studying this course, students will be able to:

1. Analyse existing solid waste management system and to identify their drawbacks.
2. Evaluate different elements of solid waste management system.
3. Suggest suitable scientific methods for solid waste management elements.
4. Design suitable processing system and evaluate disposal sites.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. George Tchobanoglous, Hilary Theisen , Samuel A Vigil, “Integrated Solid Waste Management : Engineering principles and management issues”, M/c Graw hill Education . Indian edition 2. Howard S Peavy, Donald R Rowe and George Tchobanoglous, “Environmental Engineering”, Tata Mcgraw Hill Publishing Co ltd.,
Reference Books:
1. Municipal Solid Wastes (Management and Handling) Rules, 2000.Ministry of Environment and Forests Notification, New Delhi, the 25th September, 2000. Amendment – 1357(E) – 08-04-2016 2. Municipal Solid waste management manual, Part II published under Swachh Bharat Mission, Central Public Health and Environmental Engineering Organization (CPHEEO), 2016, Ministry of Urban Development, Government of India. **3.** Handbook of Solid waste management, second edition, George Tchobanoglous, Frank Kreith, published by M/c Graw hill Education, 2002, ISBN-13 978-0071356237 ISBN -10 0071356231

B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VI			
ALTERNATE BUILDING MATERIALS			
Course Code	**18CV643**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This Course will enable students to:

1. understand environmental issues due to building materials and the energy consumption in manufacturing building materials
2. study the various masonry blocks, masonry mortar and structural behavior of masonry under compression.
3. Study the alternative building materials in the present context.
4. understand the alternative building technologies which are followed in present construction field.

Module -1

Introduction: Energy in building materials, Environmental issues concerned to building materials, Embodied energy and life-cycle energy, Global warming and construction industry, Green concepts in buildings, Green building ratings – IGBC and LEED manuals – mandatory requirements, Rainwater harvesting & solar passive architecture. Environmental friendly and cost effective building technologies, Requirements for buildings of different climatic regions.

Module -2

Elements of Structural Masonry : Elements of Structural Masonry, Masonry materials, requirements of masonry units' characteristics of bricks, stones, clay blocks, concrete blocks, stone boulders, laterite Blocks, Fal- G blocks and Stabilized mud block. Manufacture of stabilized blocks.

Structural Masonry Mortars: Mortars, cementations materials, sand, natural & manufactured, types of mortars, classification of mortars as per BIS, characteristics and requirements of mortar, selection of mortar.

Uses of masonry, masonry bonding, Compressive strength of masonry elements, Factors affecting compressive strength, Strength of Prisms/wallets and walls, Effect of brick bond on strength, Bond strength of masonry: Flexure and shear, Elastic properties of masonry materials and masonry, Design of masonry compression elements subjected to axial load.

Module -3

Alternate Building Materials: Lime, Pozzolana cements, Raw materials, Manufacturing process, Properties and uses. Fibers- metal and synthetic, Properties and applications. Fiber reinforced plastics, Matrix materials, Fibers organic and synthetic, Properties and applications. Building materials from agro and industrial wastes ,Types of agro wastes, Types of industrial and mine wastes, Properties and applications. Masonry blocks using industrial wastes. Construction and demolition wastes.

Module -4

Alternate Building Technologies: Use of arches in foundation, alternatives for wall constructions, composite masonry, confined masonry, cavity walls, rammed earth, Ferro cement and ferroconcrete building components, Materials and specifications, Properties, Construction methods, Applications.

Top down construction, Mivan Construction Technique.

Alternate Roofing Systems: Concepts, Filler slabs, Composite beam panel roofs, Masonry vaults and domes.

Module -5

Equipment for Production of Alternate Materials: Machines for manufacture of concrete, Equipments for production of stabilized blocks, Moulds and methods of production of precast elements, Cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost analysis: Case studies using alternatives.

Course Outcomes: After studying this course, students will be able to:

1. Solve the problems of Environmental issues concerned to building materials and cost effective building technologies;
2. Select appropriate type of masonry unit and mortar for civil engineering constructions; also they are able to Design Structural Masonry Elements under Axial Compression.
3. Analyse different alternative building materials which will be suitable for specific climate and in an environmentally sustainable manner. Also capable of suggesting suitable agro and industrial wastes as a building material.
4. Recommend various types of alternative building materials and technologies and design a energy efficient building by considering local climatic condition and building material.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. KS Jagadish, B V Venkatarama Reddy and K S Nanjunda Rao, “Alternative Building Materials and Technologies”, New Age International pub.
2. Arnold W Hendry, “Structural Masonry”, Macmillan Publishers.

Reference Books:

1. RJS Spence and DJ Cook, “Building Materials in Developing Countries”, Wiley pub.
2. LEED India, Green Building Rating System, IGBC pub.
3. IGBC Green Homes Rating System, CII pub.
4. Relevant IS Codes.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

GROUND IMPROVEMENT TECHNIQUES

Course Code	**18CV644**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to
1. Understand the fundamental concepts of ground improvement techniques
2. Apply knowledge of mathematics, Science and Geotechnical Engineering to solve problems in the field of modification of ground required for construction of civil engineering structures.
3. Understand the concepts of chemical compaction, grouting and other miscellaneous methods.
4. Impart the knowledge of geo synthetics, vibration, grouting and Injection.

Module -1

Formation and Development of Ground : Introduction, Formation of Rock, soil and soil profile, Soil distribution in India, Alterations of ground after formation, Reclaimed soils, Natural offshore deposits;
Ground Improvement Potential – Hazardous ground conditions, poor ground conditions, favourable ground conditions, Alternative Approaches, Geotechnical processes.
Compaction: Introduction, compaction mechanics, Field procedure, surface compaction, Dynamic Compaction, selection of field compaction procedures, compaction quality control.

Module -2

Drainage Methods: Introduction, Seepage, filter requirements, ground water and seepage control, methods of dewatering systems, Design of dewatering system including pipe line effects of dewatering. Drains, different types of drains.
Pre-compression and Vertical Drains: Importance, Vertical drains, Sand drains, Drainage of slopes, Electro kinetic dewatering, Preloading.

Module -3

Chemical Modification-I: Definition, cement stabilization, sandwich technique, admixtures. Hydration – effect of cement stabilization on permeability, Swelling and shrinkage and strength and deformation characteristics. Criteria for cement stabilization. Stabilization using Fly ash.
Chemical Modification-Ii: Lime stabilization – suitability, process, criteria for lime stabilization. Other chemicals like chlorides, hydroxides, lignin and hydrofluoric acid. Properties of chemical components, reactions and effects. Bitumen, tar or asphalt in stabilization.

Module -4

Vibration Methods: Introduction, Vibro compaction – blasting, vibratory probe, Vibro displacement compaction – displacement piles, vibro flotation, sand compaction piles, stone columns, heavy tamping
Grouting And Injection: Introduction, Effect of grouting. Chemicals and materials used. Types of grouting. Grouting procedure, Applications of grouting.

Module -5

Geosynthetics: Introduction, Geosynthetic types, properties of Geosynthetics – materials and fibre properties, Geometrical aspects, mechanical properties, Hydraulic properties, Durability ; Applications of Geosynthetics - Separation, Filtration and Fluid Transmission, Reinforcement,
Miscellaneous Methods (Only Concepts & Uses): Soil reinforcement, Thermal methods, Ground improvement by confinement – Crib walls, Gabions and Mattresses, Anchors, Rock bolts and soil nailing. Stone Column, Micro piles.

Course Outcomes: After studying this course, students will be able to:
1. Give solutions to solve various problems associated with soil formations having less strength.
2. Use effectively the various methods of ground improvement techniques depending upon the requirements.
3. utilize properly the locally available materials and techniques for ground improvement so that economy in the design of foundations of various civil engineering structures

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.

- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Purushothama Raj P, “Ground Improvement Techniques”, Laxmi Publications, New Delhi.
2. Koerner R.M, “Construction and Geotechnical Method in Foundation Engineering”, McGraw Hill Pub. Co.

Reference Books:

1. Bell, F.G., “Methods of treatment of unstable ground”, Butterworths, London.
2. Nelson J.D. and Miller D.J, “Expansive soils”, John Wiley and Sons.
3. Ingles. C.G. and Metcalf J.B , “Soil Stabilization; Principles and Practice”, Butterworths
4. Manfred Hausmann , “Engineering principles of ground modification”, McGraw Hill Pub. Co.,

B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VI			
RAILWAYS, HARBOUR, TUNNELING AND AIRPORTS			
Course Code	**18CV645**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Understand the history and development, role of railways, railway planning and development based on essential criteria's.
2. Learndifferenttypesofstructuralcomponents,engineeringpropertiesofthematerials,tocalculatethematerial quantities required for construction
3. Understand various aspects of geometrical elements, points and crossings, significance of maintenance of tracks.
4. Design and plan airport layout, design facilities required for runway, taxiway and impart knowledge about visual aids
5. Apply design features of tunnels, harbors, dock and necessary navigational aids; also expose them to various methods of tunneling and tunnel accessories.

Module-1

Railway Planning: Significance of Road, Rail, Air and Water transports – Coordination of all modes to achieve sustainability – Elements of permanent way
– Rails, Sleepers, Ballast, rail fixtures and fastenings, – Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods- – Soil suitability analysis – Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings(Explanation & Sketches of Right and Left hand turnouts only).

Module-2

Railway Construction and Maintenance: Earthwork – Stabilization of track on poor soil, Calculation of Materials required for track laying – Construction and maintenance of tracks – Modern methods of construct ion & maintenance – Railway stations and yards and passenger amenities- Urban rail – Infrastructure for Metro, Mono and underground railways.

Module-3

Harbour and Tunnel Engineering: Definition of Basic Terms: Planning and Design of Harbours: Requirements, Classification, Location and Design
Principles – Harbour Layout and Terminal Facilities , Coastal Structures, Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works.
Tunneling: Introduction, size and shape of the tunnel, tunneling methods in soils, tunnel lining, tunnel drainage and ventilation.

Module-4

Airport Planning: Air transport characteristics, airport classification, air port planning: objectives, components, layout characteristics, and socio-economic characteristics of the catchment area, criteria for airport site selection and ICAO stipulations, typical airport layouts, Parking and circulation area.

Module-5

Airport Design: Runway Design: Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles, Elements ofTaxiway Design, Airport Zones, Passenger Facilities and Services, Runway and Taxiway Markings and lighting.

Course outcomes: After studying this course, students will be able to:

1. Acquires capability of choosing alignment and also design geometric aspects of railway system, runway and taxiway.
2. Suggest and estimate the material quantity required for laying a railway track and also will be able to determine the hauling capacity of a locomotive.
3. Develop layout plan of airport, harbor, dock and will be able relate the gained knowledge to identify required type of visual and/or navigational aids for the same.
4. Apply the knowledge gained to conduct surveying, understand the tunneling activities.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook:

1. Saxena Subhash C and Satyapal Arora, "A Course in Railway Engineering", Dhanpat Rai and Sons, Delhi.
2. Satish Chandra and Agarwal M. M,"Railway Engineering", 2nd Edition, Oxford University Press,New Delhi.
3. Khanna S K, Arora M G and Jain S S,"Airport Planning and Design", Nemch and and Brothers, Roorkee.
4. CVenkatramaiah,"TransportationEngineering",VolumeII:Railways,Airports,DocksandHarbours,Bridgesand Tunnels, Universities Press.
5. Bindra S P, "A Course in Docks and Harbour Engineering", Dhanpat Rai and Sons, New Delhi.

Reference Books:

1. Oza.H.P.andOza.G.H.,"AcourseinDocks&HarbourEngineering".Charotar Publishing Co.,
2. Mundrey J. S. "A course in Railway Track Engineering".Tata Mc Graw Hill.
3. Srinivasan R. Harbour," Dock and TunnelEngineering",26thEdition2013.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

REMOTE SENSING AND GIS

Course Code	**18CV651**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to
1. Understand the basic concepts of remote sensing.
2. Analyze satellite imagery and extract the required units.
3. Extract the GIS data and prepare the thematic maps.
4. Use the thematic camps for various applications.

Module-1

Remote Sensing: Basic concept of Remote sensing, Data and Information, Remote sensing data collection, Remote sensing advantages & Limitations, Remote Sensing process. Electromagnetic Spectrum, Energy interactions with atmosphere and with earth surface features (soil, water, and vegetation), Resolution, image registration and Image and False color composite, elements of visual interpretation techniques.

Module-2

Remote Sensing Platforms and Sensors: Indian Satellites and Sensors characteristics, Remote Sensing Platforms, Sensors and Properties of Digital Data, Data Formats: Introduction, platforms-IRS, Landsat, SPOT, Cartosat, Ikonos, Envisat etc. sensors, sensor resolutions (spatial, spectral, radiometric and temporal). Basics of digital image processing- introduction to digital data, systematic errors(Scan Skew, Mirror-Scan Velocity, Panoramic Distortion, Platform Velocity , Earth Rotation) and non-systematic [random] errors(Altitude, Attitude), Image enhancements(Gray Level Thresholding, level slicing, contrast stretching),image filtering.

Module-3

Geographic Information System: Introduction to GIS; components of a GIS; Geographically Referenced Data, Spatial Data- Attribute data-Joining Spatial and attribute data, GIS Operations: Spatial Data Input – Attribute data Management, Geographic coordinate System, Datum; Map Projections: Types of Map Projections, Projected coordinate Systems. UTM Zones.

Module-4

Data Models: Vector data model: Representation of simple features – Topology and its importance; coverage and its data structure, Shape file; Relational Database, Raster Data Model: Elements of the Raster data model, Types of Raster Data, Raster Data Structure, and Data conversion.

Module-5

Integrated Applications of Remote sensing and GIS: Applications in land use land cover analysis, change detection, water resources, urban planning, environmental planning, Natural resource management and Traffic management. Location Based Services And Its Applications.

Course outcomes: After studying this course, students will be able to:
1. Collectdataanddelineatevariouselementsfromthesatelliteimageryusingtheirspectralsignature.
2. Analyze different features of ground information to create raster or vector data.
3. Perform digital classificationandcreatedifferentthematicmapsforsolvingspecificproblems
4. Make decision based on the GIS analysis on thematic maps.

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1.	Narayan Panigrahi, "Geographical Information Science", and ISBN 10: 8173716285 / ISBN 13: 9788173716287, University Press2008.
2.	Basudeb Bhatta, "Remote sensing and GIS" , ISBN:9780198072393, Oxford University Press2011
3.	Kang – T surg Chang, "Introduction to Geographic Information System". Tata McGraw Hill Education Private Limited2015.
4.	Lilles and, Kiefer, Chipman,"RemoteSensingandImageInterpretation",Wiley2011.
Reference Books:	
1.	Chor Pang Lo and Albert K.W Yeung, "Concepts &Techniques of GIS", PHI,2006
2.	John R. Jensen, "Remote sensing of the environment", an earth resources perspective–2nd edition– by Pearson Education2007.
3.	Anji Reddy M., "Remote sensing and Geographical information system", B. S. Publications2008.
4.	Peter A. Burrough, Rachael A. McDonnell, and Christopher D. Lloyd, "Principals of Geo physical Information system", Oxford Publications2004.
5.	S Kumar,"Basics of remote sensing & GIS", Laxmi publications 2005.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

TRAFFIC ENGINEERING

Course Code	**18CV652**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Understand fundamental knowledge of traffic engineering, scope and its importance.
2. Describe basic techniques for collecting and analyzing traffic data, diagnosing problems, designing appropriate remedial treatment, and assessing its effectiveness.
3. Apply probabilistic and queuing theory techniques for the analysis of traffic flow situations and emphasis the interaction of flow efficiency and traffic safety.
4. Understand and analyse traffic issues including safety, planning, design, operation and control.
5. Apply intelligent transport system and its applications in the present traffic scenario.

Module-1

Traffic Planning and Characteristics: Road Characteristics-Road user characteristics, PIEV theory, Vehicle Performance characteristics, Fundamentals of Traffic Flow, Urban Traffic problems in India, Integrated planning of town, country, regional and all urban infrastructures, Sustainable approach- land use & transport and modal integration.

Module-2

Traffic Surveys: Traffic Surveys- Speed, journey time and delay surveys, Vehicles Volume Survey including non-motorized transports, Methods and interpretation, Origin Destination Survey, Methods and presentation, Parking Survey, Accident analyses-Methods, interpretation and presentation, Statistical applications in traffic studies and traffic forecasting, Level of service-Concept, applications and significance.

Module-3

Traffic Design and Visual Aids: Intersection Design- channelization, Rotary intersection design, Signal design, Coordination of signals, Grade separation, Traffic signs including VMS and road markings, Significant roles of traffic control personnel, Networking pedestrian facilities & cycle tracks.

Module-4

Traffic Safety and Environment: Road accidents, Causes, effect, prevention, and cost, Street lighting, Traffic and environment hazards, Air and Noise Pollution, causes, abatement measures, Promotion and integration of public transportation, Promotion of non-motorized transport.

Module-5

Traffic Management: Area Traffic Management System, Traffic System Management (TSM) with IRC standards, Traffic Regulatory Measures, Travel Demand Management (TDM), Direct and indirect methods, Congestion and parking pricing, All segregation methods- Coordination among different agencies, Intelligent Transport System for traffic management, enforcement and education.

Course outcomes: After studying this course, students will be able to:

1. Understandthehumanfactorsandvehicularfactorsintrafficengineeringdesign.
2. Conductdifferenttypesoftrafficsurveysandanalysisofcollecteddatausingstatisticalconcepts.
3. Useanappropriatetrafficflowtheoryandtocomprehendthecapacity&signalizedintersectionanalysis.
4. Understand the basic knowledge of Intelligent Transportation System.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Kadiyali. L.R. “Traffic Engineering and Transport Planning ”, Khanna Publishers, Delhi,2013
2. S K Khanna and CEG Justo and AVeeraragavan, “Highway Engineering”, Nem Chand and Bros.
3. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management
4. Salter. R.I and Hounsell N.B, “Highway Traffic Analysis and design”, Macmillan PressLtd.1996.

Reference Books:

1. Fred L. Mannering, Scott S. Washburn and Walter P. Kilareski, Principles of Highway Engineering and Traffic Analysis, Wiley India Pvt. Ltd., New Delhi,2011.
2. GarberandHoel,“PrinciplesofTrafficandHighwayEngineering”,CENGAGELearning,NewDelhi,2010.
3. SP: 43-1994,IRCSpecification,“Guidelineson Low-cost Traffic Management Techniques” for Urban Areas,1994.
4. John E Tyworth, “Traffic Management Planning, Operations and control”, Addison Wesly Publishing Company, 1996.
5. Hobbs.F.D.“Traffic Planning and Engineering”,University of Brimingham,Peragamon Press Ltd,2005.

B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VI			
OCCUPATIONAL HEALTH AND SAFETY			
Course Code	**18CV653**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to
1. Gainan historical, economic, and organizational perspective of occupational safety and health;
2. Investigate current occupational safety and health problems and solutions.
3. Identify the forces that influence occupational safety and health.
4. Demonstrate the knowledge and skills needed to identify work place problems and safe work practice

Module-1

Occupational Hazard and Control Principles: Safety, History and development, National Safety Policy. Occupational safety and Health Act (OSHA), Occupational Health and Safety administration - Laws governing OSHA and right to know. Accident – causation, investigation, investigation plan, Methods of acquiring accident facts, Supervisory role in accident investigation.

Module-2

Ergonomics at Work Place: Ergonomics Task analysis, Preventing Ergonomic Hazards, Work space Envelops, Visual Ergonomics, Ergonomic Standards, Ergonomic Programs. Hazard cognition and Analysis, Human Error Analysis – Fault Tree Analysis – Emergency Response - Decision for action – purpose and considerations.

Module-3

Fire Prevention and Protection: Fire Triangle, Fire Development and its severity, Effect of Enclosures, early detection of Fire, Classification of fire and Fire Extinguishers.
Electrical Safety, Product Safety: Technical Requirements of Product safety.

Module-4

Health Considerations at Work Place: types of diseases and their spread, Health Emergency. Personal Protective Equipment (PPE) – types and advantages, effects of exposure and treatment for engineering industries, municipal solid waste. Environment management plans (EMP) for safety and sustainability.

Module-5

Occupational Health and Safety Considerations: Water and wastewater treatment plants, Handling of chemical and safety measures in water and wastewater treatment plants and labs, Construction material manufacturing industries like cement plants, RMC Plants, precast plants and construction sites. Policies, roles and responsibilities of workers, managers and supervisors.

Course outcomes: After studying this course, students will be able to:
1. Identifyhazardsintheworkplacethatposeadangerorthreattotheirsafetyorhealth,orthatofothers.
2. Controlunsafeorunhealthyhazardsandproposemethodstoeliminatethehazard.
3. Present a coherent analysis of a potential safety or health hazard both verbally and in writing, citing the occupational Health and Safety Regulations as well as supported legislation.
4. Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.
5. Identify the decisions required to maintain protection of the environment, workplace as well as personal health and safety.

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Goetsch D. L.,(1999), “Occupational Safety and Health for Technologists, Engineers and Managers”,

Prentice Hall. 2. HeinrichH.W.,(2007),“IndustrialAccidentPrevention-AScientificApproach”,McGraw-HillBookCompany National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991), 3. “Industrial Safety and Pollution Control Handbook.
Reference Books:
1. CollingD.A.,(1990),“IndustrialSafetyManagementandTechnology”,PrenticeHall,New Delhi. 2. Della D.E., and Giustina, (1996), “Safety and Environmental Management”, Van Nostrand Reinhold International Thomson Publishing Inc.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

SUSTAINABILITY CONCEPTS IN CIVIL ENGINEERING

Course Code	**18CV654**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Learn about the principles, indicators and general concept of sustainability.
2. Apprehend the local, regional and global impacts of unsustainable designs, products and processes.
3. Student shall be able to apply the sustainability concepts in engineering
4. Know built environment frame work sand their use
5. Understand how building and design is judged and valued by clients and stakeholders and how to implement sustainability.

Module-1

Introduction: Sustainability - Introduction, Need and concept of sustainability, Social-environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Multilateral environmental agreements and Protocols - Clean Development Mechanism (CDM), Environmental legislations in India - Water Act, Air Act.

Module-2

Global Environmental Issue: Resource degradation, Climate change, Regional and Local Environmental Issues. Carbon credits and carbon trading, carbon foot print Carbon sequestration – Carbon capture and storage (CCS). Environmental management standards, ISO 14000 series, Life Cycle Analysis (LCA) - Scope and Goal, Bio-mimicking.

Module-3

Sustainable Design: Basic concepts of sustainable habitat, Green buildings, green materials for building construction, material selection for sustainable design, green building certification- GRIHA & IGBC Certification for buildings, Energy efficient building design- Passive solar design technique, Thermal storage, Cooling strategies, high performance insulation. Sustainable cities, Sustainable transport.

Module-4

Clean Technology and Energy: Energy sources: Basic concepts-Conventional and non-conventional, solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans, Geothermal energy. Rainwater harvesting.

Module-5

Green Engineering: Green Engineering concepts, Sustainable Urbanization, industrialization and poverty reduction; Social and technological change, Industrial Processes: Material selection, Pollution Prevention, Industrial Ecology, Industrial symbiosis.

Course Outcomes: After studying this course, students will be able to:

1. Learn the sustainability concepts; understand the role and responsibility of engineers in sustainable development.
2. Quantify sustainability, and resource availability, Rationalize the sustainability based on scientific merits.
3. Understand and apply sustainability concepts in construction practices, designs, product developments and processes across various engineering disciplines.
4. Make a decision in applying green engineering concepts and become a lifelong advocate of sustainability in society.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.

• The students will have to answer five full questions, selecting one full question from each module.
Textbooks:
1. Allen, D.T. and S honnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall. 2. Bradley. A.S; Adebayo, A. O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
Reference Books:
1. Mackenthun, K. M.,Basic Concepts in Environmental Management, Lewis Publication. 2. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI Publications - GRIHA Rating System. 3. Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-Hill Professional. 4. Twidell, J. W. and Weir, A. D., Renewable Energy Resources, English Language Book Society (ELBS). 5. Malcolm Dowden, Climate Change and Sustainable Development: Law, Policy and Practice. 6. Daniel A. Vallero and Chris Brasier, "Sustainable Design: The Science of Sustainability and Green Engineering", Wiley-Blackwell. **7.** Sustainable Engineering Practice: An Introduction, Committee on Sustainability, American Society of Civil Engineers.

INTELLIGENT TRANSPORTATION SYSTEMS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – VI

Subject Code	**18CV655**	CIE Marks	40
Number of Lecture Hours/Week(L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning objectives: This course will enable students to

Have an awareness and scope of transport issues, such as, traffic safety, public transport, advanced vehicle management and control. Learn how Intelligent transport systems (ITS) involve the application of information technology and telecommunications to control traffic, inform travellers and drivers, operate public transport, automating payments, handle emergencies and incidents, operate commercial fleets and freight exchange, and automate driving and safety.

Module -1

Basic elements of intelligent transportation systems (ITS), focusing on technological, systems and institutional aspects. Benefits of ITS -ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic InformationSystems (GIS), video data collection.

Module -2

Advanced traveller information systems; transportation network operations; commercial vehicle operations and intermodal freight.

Module -3

Public transportation applications, ITS and regional strategic transportation planning, including regional architectures.

Module -4

ITS and changing transportation institutions, ITS and safety, ITS and security, ITS as a technology deployment program, research, development and business models, ITS andsustainable mobility.

Module -5

Travel demand management, electronic toll collection, and ITS and road-pricing.Automated Highway Systems- Vehicles in Platoons –ITS in World – Overview of ITSImplementations in developed countries, ITS in developing countries.

Course outcomes:

After studying this course, students would be able to suggest the appropriate system/s in various functional areas of transportation. Would be able to amalgamate the various systems, plan and implement the applications of ITS. Wouldhave learnt the application of information technology and telecommunication to control traffic and alsoprovide advance information to the travellers, automatic handling of emergencies and to improve safety.

Graduate Attributes (as per NBA)

- *Scholarship of Knowledge.*
- *Critical thinking.*
- *Ethical practices and social responsibility*
- *Use of modern tools*

Question paper pattern:

1. The question paper will have tenquestions.
2. Each full question consists of 20marks.
3. There will be 2 full questions (with a maximum of four sub questions) from each module.
4. Each full question will have sub questions covering all the topics under amodule.
5. The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

1. Choudury M A and Sadek A, “Fundamentals of Intelligent Transportation Systems Planning” Artech House.
2. Pradip Kumar Sarkar, Amit Kumar Jain, “Intelligent Transport Systems”, PHI Learning Publishers

Reference Books:

1. Kan Paul Chen, John Miles, “Recommendations for World Road Association (PIARC)” ITS Hand Book 2000.
2. Sussman, J. M., “Perspective on ITS”, Artech House Publishers, 2005.
3. US Department of Transportation, “National ITS Architecture Documentation”, 2007 (CDROM).
4. Turban. E and Aronson. J. E, “Decision Support Systems and Intelligent Systems”, Prentice Hall

CONSERVATION OF NATURAL RESOURCES

Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

SEMESTER – VI

Subject Code	**18CV656**	CIE Marks	40
Teaching Hours/Week(L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course learning objectives: This course will enable the students to

- Learn types of land forms , soil conservation and sustainable land use planning.
- Apprehend water resources, types, distribution, planning and conservation.
- Know the atmospheric composition of air, pollution and effects on human beings, animals and plants. Air pollution control.
- Apprehend basics of biodiversity and ecosystems.
-

Module -1

Land: Land as a resource, types of lands, conservation of land forms, deforestation, effect of land use changes. Soil health, ecological and economic importance of soil, impact of soil degradation on agriculture and food security, need for soil conservation, sustainable land use planning.

Module -2

Water: Global water resources, Indian water resources, Resources system planning. Water use sectors- domestic, industrial, agriculture. Water deficit and water surplus basins in India, equitable distribution, Inter-basin water transfers, Interlinking of rivers – Himalayan component, peninsular component, issues involved. Ground water, its potential in India, conjunctive use, recharge of ground water. Contamination of ground water, sea water ingress, problems and solutions.

Module -3

Air: Introduction, composition, sources and classification of air pollutants, National Ambient Air quality standards (NAAQS), Air quality index, effects of air pollution on human health. Economic effects of air pollution. Control of air pollution by equipment, smoke and its control. Ozone depletion –impacts, photochemical changes.

Minerals and rocks: Minerals, important rock forming minerals like Quartz, Mica, Feldspar and Amphibole, lithification & metamorphism, weathering: physical, biogeochemical processes, erosion, agents of erosion.

Module -4

Biodiversity: Introduction, Flora and Fauna, Importance of biodiversity, Economic values-medicinal plants, drugs, fisheries biogeochemical cycling. Threat to biodiversity, natural & anthropogenic disturbance, habitat loss. Conservation of biodiversity, National parks, wild life sanctuaries, zoological gardens, gene banks, pollen culture, ecological restoration, social forestry. Ecosystem: Definition, Types: forest, grass land, marine, desert, wetlands, estuarine, lotic, lentic. Abiotic & biotic components of eco system.

Module -5

Global warming: concept, indicators, factors and effects. Global climate change-indicators, health impacts, effect on biodiversity. Introduction to global efforts in conservation of biodiversity.

EIA: Regulations in India, status of EIA in India, list of projects needing environmental clearance under EIA notifications. Case study of hydro power/ thermal power projects.

Course Outcomes(CO):

At the end of the course, students will be able to

1. Apprehend various components of land as a natural resource and land use planning.
2. Know availability and distribution for water resources as applied to India.
3. Analyse the components ofair as resource and its pollution.
4. Discuss biodiversity & its role in ecosystem functioning.
5. Critically appreciate the environmental concerns of today.

Question paper pattern:

1. The question paper will have ten questions, carrying equal marks.
2. There will be two full questions with a maximum four sub questions from each module. Students shall answer five full questions selecting one full question from each module.

Text Books:

1. Modi, P.N., "Irrigation Water Resources and Water Power Engineering". Standard Book House, New Delhi. 10th Edition, 2019.
2. Raghunath, H.M., "Groundwater",3rd Edition, New Age International Publishers, New Delhi, 2007.
3. Krishnan, M.S., "Geology of India & Burma". CBS publishers, New Delhi, 2017.
4. P.Jaya Rami Reddy, "A Textbook of Hydrology", University Science Press, New Delhi, 2011.
5. M N Rao and H V N Rao, "Air pollution", McGraw Hill Publications, 2017.
6. Krishnamurthy K.V., "An advanced textbook of Biodiversity- Principle &Practices." Oxford and IBH publications, New Delhi. 2004.

Reference Books :

1. Odum, E.P., "Fundamentals of Ecology", W.B sounders, Philadelphia, USA, 1971
2. Singh J.S, Singh S.P & Gupta, S.R.,"Ecology, environment and resource conservation",Anamayapublications, 2006.
3. Edmond A. Mathez & Jason E. Smerdon, "Climate Change: The science of Global warming and our energy feature", Columbia University Press, 2009.
4. National Council of Applied Economic Research, "Economic Impact of Interlinking of Rivers Program", Revised Final Report, April 2008.
5. http://nwda.gov.in/content.
6. Madhav Gadagil, "Biodiversity and India's degraded lands", Indian Academy of Sciences, Volume 22- No 2/3, http://www.jstor.org/pss/4314063

B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VI			
SOFTWARE APPLICATION LABORATORY			
Course Code	**18CVL66**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Use industry standard software in a professional set up.
2. Understand the elements of finite element modeling, specification of loads and boundary condition, performing analysis and interpretation of results for final design.
3. Develop customized automation tools.

Module -1

Use of civil engineering software's:

Use of software's for:

1. Analysis of plane trusses, continuous beams, portal frames.
2. 3D analysis of multistoried frame structures.

Module -2

1. **Project Management- Exercise on Project planning and scheduling of a building project using any project management software:**

a. Understanding basic features of Project management software
b. Constructing Project: create WBS, Activities, and tasks and Computation Time using Excel spread sheet and transferring the same to Project management software.
c. Identification of Predecessor and Successor activities with constrain
d. Constructing Network diagram (AON Diagram) and analyzing for Critical path, Critical activities and Othernon Critical paths, Project duration, Floats.
e. Study on various View options available
f. Basic understanding about Resource Creation and allocation
g. Understanding about Splitting the activity, Linking multiple activity, assigning Constrains, Merging Multiple projects, Creating Baseline Project

1. **GIS applications using open source software:**

a. To create shape files for point, line and polygon features with a map as reference.
b. To create decision maps for specific purpose.

Module -3

Use of EXCEL spread sheets:

Design of singly reinforced and doubly reinforced rectangular beams, design of one way and two way slabs, computation of earthwork, Design of horizontal curve by offset method, Design of super elevation.

Course Outcomes: After studying this course, students will be able to:

use software skills in a professional set up to automate the work and thereby reduce cycle time for completion of the work

Question paper pattern:

- The question paper will have 6 questions under 3 modules.
- There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.
- Each full question shall cover the topics under a module.
- Module-1: 40 Marks, Module-2: 30 Marks, Module-3: 30 Marks.
- The students shall answer three full questions, selecting one full question from each module.

Reference Books: Training manuals and User manuals and Relevant course reference books

B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VI			
ENVIRONMENTAL ENGINEERING LABORATORY			
Course Code	**18CVL67**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives: This course will enable students,

1. To learn different methods of water & waste water quality
2. To conduct experiments to determine the concentrations of water and waste water
3. To determine the degree and type of treatment
4. To understand the environmental significance and application in environmental engineering practice

1. Preparation chemical solutions required for analysis and sampling methodologies
2. Determination of pH, Conductivity, TDS and Turbidity.
3. Determination of Acidity and Alkalinity
4. Determination of Calcium, Magnesium and Total Hardness.
5. Determination of Dissolved Oxygen
6. Determination of BOD.
7. Determination of Chlorides
8. Determination of percentage of % of available chlorine in bleaching powder sample, Determination of Residual Chlorine and chlorine demand.
9. Determination of Solids in Sewage: i) Total Solids, ii) Suspended Solids, iii) Dissolved Solids, iv) Volatile Solids, Fixed Solids v) Settleable Solids.
10. Determination of optimum coagulant dosage using Jar test apparatus.
11. Determination Nitrates and Iron by spectrophotometer
12. Determination of COD(Demonstration)
13. Air Quality Monitoring (Demonstration)
14. Determination of Sound by Sound level meter at different locations (Demonstration)

Course Outcomes: After studying this course, students will be able to:

1. Acquire capability to conduct experiments and estimate the concentration of different parameters.
2. Compare the result with standards and discuss based on the purpose of analysis.
3. Determine type of treatment, degree of treatment for water and waste water.
4. Identify the parameter to be analyzed for the student project work in environmental stream.

Question paper pattern:

- Two experiments shall be asked from the above set of experiments.
- One experiment to be conducted and for the other student should write detailed procedure.

Reference Books:

1. IS codes-3025 series
2. Standard method for examination of water and waste water, APHA, 20th edition
3. Clair Sawyer and Perry McCarty and Gene Parkin, “Chemistry for Environmental Engineering and Science”, McGraw-Hill Series in Civil and Environmental Engineering.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

EXTENSIVE SURVEY PROJECT

Course Code	**18CVEP68**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(0:2:2)	SEE Marks	60
Total Number of Practice Hours	02	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Understand the practical applications of Surveying.
2. Use Total station and other Measurement Equipments.
3. Work in teams and learn time management, communication and presentation skills

Note:

- To be conducted between 5th & 6th Semester for a period of 2 weeks including training on total station.
- Viva voce conducted along with 6th semester exams
- An extensive project preparation training involving investigation, collection of data is to be conducted. **Use of Total Station is compulsory for minimum of TWO projects.**
- The student shall submit a project report consisting of designs and drawings.
- Drawings should be done using CAD and survey work using total station
- Students should learn data download from total station, generation of contours, block leveling, longitudinal and cross sectional diagrams, and capacity volume calculation by using relevant softwares
- The course coordinators should give exposure and simulate activities to achieve the course outcomes

1. **NEW TANK PROJECTS:** The work shall consist of;
   a. Reconnaissance survey for selection of site and conceptualization of project.
   b. Alignment of center line of the proposed bund, Longitudinal and cross sections of the center line.
   c. Detailed survey required for project execution like Capacity surveys, Details at Waste weir and sluice points, Canal alignment etc. as per requirement
   d. Design and preparation of drawing with report.
2. **WATER SUPPLY AND SANITARY PROJECT:** The work shall consist of;
   a. Reconnaissance survey for selection of site and conceptualization of project.
   b. Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population.
   c. Preparation of village map by using total station.
   d. Survey work required for laying of water supply and UGD
   e. Location of sites for water tank. Selection of type of water tank to be provided. (ground level, overhead and underground)
   f. Design of all elements and preparation of drawing with report.
3. **HIGHWAY PROJECT:** The work shall consist of;
   a. Reconnaissance survey for selection of site and conceptualization of project.
   b. Preliminary and detailed investigations to align a new road (min. 1 to 1.5 km stretch) between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Surveying by using total station.
   c. Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed.
   d. Drawing shall include key plan initial alignment, final alignment, longitudinal section along final alignment, typical cross sections of road.
4. **RESTORATION OF AN EXISTING TANK:** The work shall consist of;
   a. Reconnaissance survey for selection of site and conceptualization of project.
   b. Alignment of center line of the existing bund, Longitudinal and cross sections of the center line.
   c. Detailed survey required for project execution like Capacity surveys, Details at Waste weir and sluice points, Canal alignment etc. as per requirement
   d. Design of all elements and preparation of drawing with report.

5. **TOWN/HOUSING / LAYOUT PLANNING:** The work shall consist of;

a. Reconnaissance survey for selection of site and conceptualization of project.
b. Detailed survey required for project execution like contour surveys
c. Preparation of layout plans as per regulations
e. Centerline marking-transfer of centre lines from plan to ground
f. Design of all elements and preparation of drawing with report as per regulations

Course outcomes: After studying this course, students will be able to:

1. Apply Surveying knowledge and tools effectively for the projects
2. Understanding Task environment, Goals, responsibilities, Task focus, working in Teams towards common goals, Organizational performance expectations, technical and behavioral competencies.
3. Application of individual effectiveness skills in team and organizational context, goal setting, time management, communication and presentation skills.
4. Professional etiquettes at workplace, meeting and general
5. Establishing trust based relationships in teams & organizational environment
6. Orientation towards conflicts in team and organizational environment, Understanding sources of conflicts, Conflict resolution styles and techniques

Reference Books:

Training manuals and User manuals
Relevant course reference books

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

QUANTITY SURVEYING AND CONTRACT MANAGEMENT

Course Code	**18CV71**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to;
1. Estimate the quantities of work, develop the bill of quantities and arrive at the Cost of civil engineering Project
2. Understand and apply the concept of Valuation for Properties
3. Understand, Apply and Create the Tender and Contract document.

Module -1

Quantity Estimation for Building: study of various drawing attached with estimates, important terms, units of measurements, abstract, Types of estimates. Estimation of building by Short wall and long wall method - centre line method.
Estimate of R.C.C structures including Slab, beam, column, footings.

Module -2

Estimate of Steel truss, manhole and septic tanks and slab culvert.
Quantity Estimation for Roads: Computation of volume of earthwork fully in banking, cutting, partly cutting and partly Filling by mid-section, trapezoidal and Prismoidal Methods.

Module -3

Specification for Civil Engineering Works: Objective of writing specifications essentials in specifications, general and detail specifications of different items of works in buildings and roads.
Analysis of Rates : Factors Affecting Cost of Civil Works , Concept of Direct Cost , Indirect Cost and Project Cost
Rate analysis and preparation of bills, Data analysis of rates for various items of Works, Sub-structure components, Rate analysis for R.C.C. slabs, columns and beams.

Module-4

Contract Management-Tender and its Process: Invitation to tender, Prequalification, administrative approval & Technical sanction. Bid submission and Evaluation process. Contract Formulation: Letter of intent, Award of contract, letter of acceptance and notice to proceed. Features / elements of standard Tender document (source: PWD / CPWD / International Competitive Bidding – NHAI / NHEPC / NPC).
Law of Contract as per Indian Contract act 1872, Types of Contract, Joint venture.
Contract Forms: FIDIC contract Forms, CPWD, NHAI, NTPC, NHEPC.

Module -5

Contract Management-Post award : Basic understanding on definitions, Performance security, Mobilization and equipment advances, Secured Advance, Suspension of work, Time limit for completion, Liquidated damages and bonus, measurement and payment, additions and alterations or variations and deviations, breach of contract, Escalation, settlement of account or final payment, claims, Delay's and Compensation, **Disputes & its resolution mechanism,** Contract management and administration.
Valuation: Definitions of terms used in valuation process, Purpose of valuation, Cost, Estimate, Value and its relationship, Capitalized value. Freehold and lease hold and easement, Sinking fund, depreciation–methods of estimating depreciation, Outgoings, Process and methods of valuation: Rent fixation, valuation for mortgage, valuation of land.

Course outcomes: After studying this course, students will be able to:
1. Taking out quantities and work out the cost and preparation of abstract for the estimated cost for various civil engineering works.
2. Prepare detailed and abstract estimates for various road works, structural works and water supply and sanitary works.
3. Prepare the specifications and analyze the rates for various items of work.
4. Assess contract and tender documents for various construction works.
5. Prepare valuation reports of buildings.

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.

- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Datta B.N., "Estimating and costing", UBSPD Publishing House, New Delhi.
2. B.S. Patil, "Civil Engineering Contracts and Estimates", Universities Press.
3. M. Chakraborthi; "Estimation, Costing and Specifications", Laxmi Publications.
4. MORTH Specification for Roads and Bridge Works – IRC New Delhi.

Reference Books:

1. Kohli D.D and Kohli R.C, "Estimating and Costing", 12 th Edition, S.Chand Publishers, 2014.
2. Vazirani V.N and Chandola S.P, "Estimating and costing", Khanna Publishers, 2015.
3. Rangwala, C. "Estimating, Costing and Valuation", Charotar Publishing House Pvt. Ltd., 2015.
4. Duncan Cartlidge , "Quantity Surveyor's Pocket Book", Routledge Publishers, 2012.
5. Martin Brook, "Estimating and Tendering for Construction Work", A Butterworth-Heinemann publishers, 2008.
6. Robert L Peurifoy , Garold D. Oberlender , " Estimating Construction Costs" – 5ed , Tata McGraw-Hill , New Delhi.
7. David Pratt, "Fundamentals of Construction Estimating" – 3ed, Edition.
8. PWD Data Book, CPWD Schedule of Rates (SoR). and NH SoR – Karnataka FIDIC Contract forms.
9. B.S. Ramaswamy "Contracts and their Management" 3ed, Lexis Nexis(a division of Reed Elsevier India Pvt Ltd).

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

DESIGN OF RCC AND STEEL STRUCTURES

Course Code	**18CV72**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to
1. Provide basic knowledge in the areas of limit state method and concept of design of RC and Steel structures
2. Identify, formulate and solve engineering problems in RC and Steel Structures
3. Give procedural knowledge to design a system, component or process as per needs and specifications of RC Structures like Retaining wall, Footing, Water tanks, Portal Frames and Steel Structures like Roof Truss, Plate Girder and Gantry Girder.
4. Imbibe the culture of professional and ethical responsibilities by following codal provisions in the analysis, design of RC and Steel Structures.
5. Provide factual knowledge on analysis and design of RC Structural elements, who can participate and succeed in competitive examinations.

Module -1

Footings: Design of rectangular slab, slab-beam type combined footing.
Retaining Walls: Design of cantilever Retaining wall and counter fort retaining wall.
Water Tanks: Design of circular water tanks resting on ground (Rigid and Flexible base). Design of rectangular water tanks resting on ground. **As per IS: 3370 (Part IV).**
Design of portal frames with fixed and hinged based supports.

Module -2

Roof Truss: Design of roof truss for different cases of loading, forces in members to given.
Plate Girder: Design of welded plate girder with intermediate stiffener, bearing stiffener and necessary checks
Gantry Girder: Design of gantry girder with all necessary checks.

Course Outcomes: After studying this course, students will be able to:
1. Students will acquire the basic knowledge in design of RCC and Steel Structures.
2. Students will have the ability to follow design procedures as per codal provisions and skills to arrive at structurally safe RC and Steel members.

Question Paper Pattern:
- Two questions shall be asked from each module. There can be maximum of three subdivisions in each question, if necessary.
- One full question should be answered from each module.
- Each question carries 50 marks.
- Code books – IS 456, IS 800, IS 3370 (Part IV), SP-16, SP (6) – Steel Tables, shall be referred for designing. The same will be provided during examination.

Textbooks:
1. N Krishna Raju, **"Structural Design and Drawing of Reinforced Concrete and Steel"**, University Press
2. Subramanian N, **"Design of Steel Structures"**, Oxford university Press, New Delhi
3. K S Duggal, **"Design of Steel Structures"**, Tata McGraw Hill, New Delhi

Reference Books:
1. Charles E Salman, Johnson & Mathas, **"Steel Structure Design and Behavior"**, Pearson Publications
2. Nether Cot, et.al, **"Behavior and Design of Steel Structures to EC -III"**, CRC Press
3. P C Verghese, **"Limit State Design of Reinforced Concrete"**, PHI Publications, New Delhi
4. S N Sinha, **"Reinforced Concrete Design"**, McGraw Hill Publication

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

THEORY OF ELASTICITY

Course Code	**18CV731**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. This course advances students from the one-dimensional and linear problems conventionally treated in courses of strength of materials in to more general, two and three-dimensional problems.
2. The student will be introduced to rectangular and polar coordinate systems to describe stress and strain of a continuous body.
3. Introduction to the stress–strain relationship, basic principles and mathematical expressions involved in continuum mechanics. Also solution of problems in 2-dimensional linear elasticity.

Module-1

Rigid and deformable bodies, body and surface forces, concept of stress, state of stress at a point, Cartesian stress components, Cauchey's stress formula, stress transformation, principal stresses and principal planes, stress invariants, equations of equilibrium in 2D and 3D (Cartesian coordinates).

Module-2

Types of strain, strain displacement relations, state of strain at a point, strain tensor, strain transformation, strain along a linear element, principal strains, strain invariants, octahedral strains, spherical and deviatoric strains.

Module-3

Generalized Hooke's Law, Stress-strain relationships, Equilibrium equations in terms of displacements and Compatibility equations in terms of stresses, Plane stress and plane strain problems, St. Venant's principle, Principle of superposition, Uniqueness theorem, Airy's stress function, Stress polynomials (Two Dimensional cases only). Equations of equilibrium in polar coordinate, compatibility equation, stress function.

Module-4

Axisymmetric stress distribution - Rotating discs, Lame's equation for thick cylinder, Effect of circular hole on stress distribution in plates subjected to tension, compression and shear, stress concentration factor.

Module-5

Torsion: Inverse and Semi-inverse methods, stress function, torsion of circular, elliptical, triangular sections.

Course outcomes: After studying this course, students will be able to:

1. Ability to apply knowledge of mechanics and mathematics to model elastic bodies as continuum.
2. Ability to formulate boundary value problems; and calculate stresses and strains.
3. Ability to comprehend constitutive relations for elastic solids and compatibility constraints.
4. Ability to solve two-dimensional problems (plane stress and plane strain) using the concept of stress function.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. S P Timoshenko and J N Goodier, "Theory of Elasticity", McGraw-Hill International Edition, 1970.
2. Sadhu Singh, "Theory of Elasticity", Khanna Publishers, 2012.
3. S Valliappan, "Continuum Mechanics - Fundamentals", Oxford &IBH Pub. Co. Ltd., 1981.
4. L S Srinath, "Advanced Mechanics of Solids", Tata - McGraw-Hill Pub., New Delhi, 2003.

Reference Books:

1. C. T. Wang, "Applied Elasticity", Mc-Graw Hill Book Company, New York,1953.
2. G. W. Housner and T. Vreeland, Jr., "The Analysis o f Stress and Deformation", California Institute of Tech., CA, 2012.[Downloadasperuserpolicyfromhttp://resolver.caltech.edu/CaltechBOOK:1965.001].
3. A. C. Ugural and Saul K. Fenster, "Advanced Strength and Applied Elasticity", PrenticeHall,2003.
4. Abdel-Rahman Ragab and Salah Eldinin Bayoumi, "Engineering Solid Mechanics: Fundamentals and Applications", CRC Press,1998.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

AIR POLLUTION AND CONTROL

Course Code	**18CV732**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to
1. Study the sources and effects of air pollution
2. Learn the meteorological factors influencing air pollution.
3. Analyze air pollutant dispersion models
4. Illustrate particular and gaseous pollution control methods.

Module-1

Introduction: Definition, Sources, classification and characterization of air pollutants. Effects of air pollution on health, vegetation & materials. Types of inversion, photochemical smog.

Module-2

Meteorology: Temperature lapse rate & stability, wind velocity & turbulence, plume behavior, measurement of meteorological variables, wind rose diagrams, Plume Rise, estimation of effective stack height and mixing depths.

Module-3

Sampling: Sampling of particulate and gaseous pollutants (Stack, Ambient & indoor air pollution), Monitoring and analysis of air pollutants ($PM_{2.5}$, PM_{10}, SO_X, NO_X, CO, NH_3). Development of air quality models-Gaussian dispersion model-Including Numerical problems.

Module-4

Control Techniques: Particulate matter and gaseous pollutants- settling chambers, cyclone separators, scrubbers, filters & ESP - Including Numerical problems. Site selection for industrial plant location.

Module-5

Air pollution due to automobiles, standards and control methods. Noise pollution- causes, effects and control, noise standards. Environmental issues, global episodes. Environmental laws and acts.

Course outcomes: After studying this course, students will be able to:
1. Identify the major sources of air pollution and understand their effects on health and environment.
2. Evaluate the dispersion of air pollutants in the atmosphere and to develop air quality models.
3. Ascertain and evaluate sampling techniques for atmospheric and stack pollutants.
4. Choose and design control techniques for particulate and gaseous emissions.

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. M. N. Rao and H V N Rao, “Air pollution”, Tata Mc-G raw Hill Publication.
2. H. C. Perkins, “Air pollution”. Tata McGraw Hill Publication.
3. Mackenzie Davis and David Cornwell, “Introduction t o Environmental Engineering” McGraw-Hill Co.

Reference Books:

1. Noel De Nevers, “Air Pollution Control Engineering”, Waveland Pr Inc.
2. Anjaneyulu Y, “Text book of Air Pollution and Control Technologies”, Allied Publishers.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

PAVEMENT MATERIALS AND CONSTRUCTION

Course Code	**18CV733**	CIE Marks	40
Teaching Hours/Week	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

1. Expose students to different materials which are used in pavement construction, impart knowledge about the engineering properties required.
2. To train students to perform various types of bituminous mix designs as per the guidelines (MORTH).
3. Student will get knowledge about different highway construction equipment with their suitability and adaptability in various field scenarios.
4. Expose students to construction practice and quality control aspects of embankment, flexible and rigid pavement as per the required specifications (MORTH).
5. To introduce students to possible improvisation in various layers of pavement to increase the structural strength by the use of non basic materials (DLC, polythene sheets).

Module-1

Pavement Materials
Aggregates- Origin, Classification, Requirements, properties and tests on Road aggregates, Concepts of size and gradation- design gradation, maximum aggregate size, aggregate blending by different methods to meet specification.
Bitumen and Tar- Origin, Preparation, Properties and Chemical Constitution of bituminous road binders, Requirements.

Module-2

Bituminous emulsion and Cutbacks- Preparation, Characteristics, uses and test. Adhesion of bitumen binders to road aggregates, Adhesion failure, Mechanism of stripping, tests and methods of improving adhesion.

Module-3

Bituminous mixes: Mechanical properties, dense and open textured mixes, flexibility and brittleness, (No Hveemstabilo meter and Hubbar- field tests) bituminous mixes, Design methods using Rothfutch's method only and specification, Marshall mix design criteria, voids in mineral aggregates, voids in total mix, density, flow, stability, percentage voids filled with bitumen. Problems on above.

Module-4

Equipments in highway construction: Various types of equipments for excavation, grading and compaction- their working principles, advantages and limitations. Special equipment for bituminous and cement concrete pavement and stabilized soil road construction.
Sub grade: Earthwork grading and Construction of embankments and cuts for roads, Preparation of subgrade, quality control tests.

Module-5

Flexible Pavements: Specifications of materials, Construction method and field control checks for various types of flexible pavement layers.
Cement Concrete Pavements: Specifications and method of cement concrete pavement construction (PQC, importance of providing DLC as sub base and polythene thin layer between PQC and sub base). Quality control tests, Construction of various types of joints.

Course outcomes: At the end of the course the student will be able to:

1. Students will be able to evaluate and assess the suitability of any pavement material to be used in various components of pavement by conducting required tests as per IS,IRC specifications
2. Students will be able to formulate the proportions of different sizes of aggregates to suit gradation criteria for various mixes as per MORTH and also design bituminous mixes.
3. Students will be competent to adapt suitable modern technique and equipment for speedy and economic construction.
4. Student will be able to execute the construction of embankment, flexible, rigid pavement and perform required quality control tests at different stages of pavement construction.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Highway Engineering- Khanna, S.K., and Justo, C.E.G.: Nem Chand and Bros. Roorkee.
2. Construction Equipment and its Management- Sharma, S.C.:Khanna Publishers.
3. Hot Mix Asphalt Materials, Mixture Design and Construction- Freddy L. Roberts, Kandhal, P.S: University of Texas Austin, Texas. NAPA Education Foundation Lanham, Maryland.

Reference Books

1. RRL, DSIR, 'Bituminous Materials in Road Construction', HMSO Publication.
2. RRL, DSIR, 'Soil Mechanics for Road Engineers', HMSO Publication.
3. Relevant IRC codes and MoRT& H specifications.

Web links and Video Lectures:

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU EDUSAT PROGRAMME - 20

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SEMESTER - VII

GROUND WATER HYDRAULICS

Course Code	**18CV734**	IA Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	Exam Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students
1. To characterize the properties of ground water and aquifers.
2. To quantify the ground water flow.
3. To locate occurrence of ground water and augment ground water resources.
4. To synthesize ground water development methods.

Module -1

Introduction: Importance, vertical distribution of subsurface water, occurrence in different types of rocks and soils, definitions-aquifers, aquifuge, aquitard, aquiclude, confined and Unconfined aquifers.

Module -2

Fundamentals of Ground Water Flow: Aquifer parameters, specific yield and specific retention, porosity, storage coefficient, derivation of the expression, Darcy's law, hydraulic conductivity, coefficient of permeability and intrinsic permeability, transmissibility, permeability in isotropic, anisotropic layered soils.

Module -3

Well Hydraulics: Steady Flow, Radial flow in confined and unconfined aquifers, pumping test Unsteady Flow, General equation, derivation; thesis method, Cooper and Jacob method, Chow's method, solution of unsteady flow equations, leakyaquifers (only introduction), interference of well, image well theory.

Module -4

Ground Water Exploration: Seismic method, electrical resistively method, Geo-physical techniques, electrical logging, radioactive logging, induction logging, sonic and fluid logging.

Module -5

Ground Water Development: Types of wells, methods of construction, tube well design, dug wells, pumps for lifting water, working principles, power requirement, Conjunctive use, necessity, techniques and economics.

Ground Water Recharge: Artificial recharge, Rainwater harvesting for ground water recharge.

Course outcomes: After studying this course, students will be able to:
1. Find the characteristics of aquifers.
2. Estimate the quantity of ground water by various methods.
3. Locate the zones of ground water resources.
4. Select particular type of well and augment the ground water storage.

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. H.M. Raghunath, "Ground Water", Wiley Eastern Publication, New Delhi.
2. K. Todd, "Ground Water Hydrology", Wiley and Sons, New Delhi.
3. Bower. H., "Ground Water Hydrology" McGraw Hill, New Delhi.

Reference Books:

1. GargSatyaPrakash, "Ground Water and Tube Wells", Oxford and IBH, New Delhi.
2. W. C. Walton, "Ground Water Resources and Evaluation" McGraw Hill, Delhi.
3. Michel, D. M., Khepar, S. D., Sondhi, S. K., "Water Wells and Pumps" McGraw Hill, Delhi.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

MASONRY STRUCTURES

Course Code	**18CV735**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Understand properties of masonry units, strength and factors affecting strength.
2. Understand design criteria of various types of wall subjected to different load system.
3. Impart the culture of following the codes for strength, serviceability and durability as an ethics.
4. Provide knowledge in analysis and design of masonry elements for the success in competitive examinations.

Module-1

Masonry Units, Materials, types and masonry construction: Bricks, Stone and Block masonry units-strength, modulus of elasticity and water absorption of masonry materials–classification and properties of mortars. Defects and Errors in masonry construction – cracks in masonry, types, reason for cracking, methods of avoiding cracks.
Strength and Stability: Strength and stability of axially loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship. Compressive strength formulae based on elastic theory and empirical formulae.

Module-2

Permissible stresses: Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and lateral load, permissible tensile stress and shear stresses.
Design Considerations: Effective height of wall sand columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. Problems on design considerations for solid walls, cavity walls, wall with pillars.

Module-3

Load considerations and design of Masonry subjected to axial loads: Design criteria, design examples of walls under UDL, solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers.

Module-4

Design of walls subjected to concentrated axial loads: Solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers, design of wall with openings.
Design of walls subjected to eccentric loads: Design criteria – stress distribution under eccentric loads –Problems onec centrically loaded solid walls, cavity walls, walls with piers.

Module-5

Design of Laterally and transversely loaded walls: Design criteria, design of solid wall under wind loading, design of shear wall – design of compound walls.
Introduction to reinforced brick masonry, lintels and slabs.
In-filled frames: Types – modes of failures – design criteria of masonry retaining walls.

Course outcomes: After studying this course, students will be able to:

1. Select suitable material for masonry construction by understanding engineering properties.
2. Compute loads, load combinations and analyze the stresses in masonry.
3. Design masonry under compression (Axial load) for various requirements and conditions.
4. Design masonry under bending (Eccentric, lateral, transverse load) for various requirements and conditions.
5. Assess the behavior of shear wall and reinforced masonry.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:
1. Dayaratnam P, “Brick and Reinforced Brick Structures”, Scientific International Pvt. Ltd. 2. M. L. Gambhir, “Building and Construction Materials”, McGraw Hill education Pvt. Ltd.
Reference Books:
1. Henry, A.W., “Structural Masonry”, Macmillan Education Ltd.,1990. 2. IS 1905–1987 “Code of practice for structural use o f un-reinforced masonry- (3rd revision) BIS, New Delhi. **3.** SP20(S&T)–1991,“Hand book on masonry design and construction(1st revision) BIS, New Delhi.

B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VII			
EARTHQUAKE ENGINEERING			
Course Code	**18CV741**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to learn about

1. Fundamentals of engineering seismology
2. Irregularities in building which are detrimental to its earthquake performance
3. Different methods of computation seismic lateral forces for framed and masonry structures
4. Earthquake resistant design requirements for RCC and Masonry structures
5. Relevant clauses of IS codes of practice pertinent to earthquake resistant design of structures

Module -1

Engineering Seismology: Terminologies (Focus, Focal depth, Epicenter, etc.); Causes of Earthquakes; Theory of plate tectonics; Types and characteristics faults; Classification of Earthquakes; Major past earthquakes and their consequences; Types and characteristics of seismic waves; Magnitude and intensity of earthquakes; local site effects; Earthquake ground motion characteristics: Amplitude, frequency and duration; Seismic zoning map of India; (Problems on computation of wave velocities. Location of epicenter, Magnitude of earthquake).

Module -2

Response Spectrum: Basics of structural dynamics; Free and forced vibration of SDOF system; Effect of frequency of input motion and Resonance; Numerical evaluation of response of SDOF system (Linear acceleration method), Earthquake Response spectrum: Definition, construction, Characteristics and application; Elastic design spectrum.

Module -3

Seismic Performance of Buildings and Over View of IS-1893 (Part-1): Types of damages to building observed during past earthquakes; Plan irregularities; mass irregularity; stiffness irregularity; Concept of soft and weak storey; Torsional irregularity and its consequences; configuration problems; continuous load path; Architectural aspects of earthquake resistant buildings; Lateral load resistant systems. Seismic design philosophy; Structural modeling; Code based seismic design methods.

Module -4

Determination of Design Lateral Forces: Equivalent lateral force procedure and dynamic analysis procedure. Step by step procedures for seismic analysis of RC buildings using Equivalent static lateral force method and response spectrum methods (maximum of 4 storeys and without infill walls).

Module -5

Earthquake Resistant Analysis and Design of RC Buildings: Typical failures of RC frame structures, Ductility in Reinforced Concrete, Design of Ductile Reinforced Concrete Beams, Seismic Design of Ductile Reinforced Concrete column, Concept of weak beam-strong column, Detailing of Beam-Column Joints to enhance ductility, Detailing as per IS-13920. Retrofitting of RC buildings

Earthquake Resistant Design of Masonry Buildings: Performance of Unreinforced, Reinforced, Infill Masonry Walls, Box Action, Lintel and sill Bands, elastic properties of structural masonry, lateral load analysis, Recommendations for Improving performance of Masonry Buildings during earthquakes; Retrofitting of Masonry buildings.

Course outcomes: After studying this course, students will be able to:

1. Acquire basic knowledge of engineering seismology.
2. Develop response spectra for a given earthquake time history and its implementation to estimate response of a given structure.
3. Understanding of causes and types of damages to civil engineering structures during different earthquake scenarios.
4. Analyze multi-storied structures modeled as shear frames and determine lateral force distribution due to earthquake input motion using IS-1893 procedures.
5. Comprehend planning and design requirements of earthquake resistant features of RCC and Masonry

structures thorough exposure to different IS-codes of practices.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Pankaj Agarwal and Manish Shrikande, "Earthquake resistant design of structures", PHI India.
2. S.K. Duggal, "Earthquake Resistant Design of Structures", Oxford University Press
3. Anil K. Chopra, "Dynamics of Structures: Theory and Applications to Earthquake Engineering", Pearson Education, Inc.
4. T. K. Datta, "Seismic Analysis of Structures", John Wiley & Sons (Asia) Ltd.

Reference Books:

1. David Dowrick, "Earthquake resistant design and risk reduction", John Wiley and Sons Ltd.
2. C. V. R. Murty, Rupen Goswami, A. R. Vijayanarayanan & Vipul V. Mehta, "Some Concepts in Earthquake Behaviour of Buildings", Published by Gujarat State Disaster Management Authority, Government of Gujarat.
3. IS-13920 – 2016, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces, BIS, New Delhi.
4. IS-1893 – 2016, Indian Standard Criteria for Earthquake Resistant Design of Structures, Part-1, BIS, New Delhi.
5. IS- 4326 – 2013, Earthquake Resistant Design and Construction of Buildings, BIS, New Delhi.
6. IS-13828 – 1993, Indian Standard Guidelines for Improving Earthquake Resistance of Low Strength Masonry Buildings, BIS, New Delhi.
7. IS-3935 – 1993, Repair and Seismic Strengthening of Buildings-Guidelines, BIS, New Delhi.

B. E. CIVIL ENGINEERING
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SEMESTER - VII

DESIGN CONCEPT OF BUILDING SERVICES

Course Code	**18CV742**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Learn the importance of sanitation, domestic water supply, and plumbing and fire services.
2. Understand the concepts of heat, ventilation and air conditioning.
3. Develop technical and practical knowledge in Building Services.

Module -1

Water Supply and its Services.
Water requirements for different types of buildings, simple method of removal of impurities, water saving practices and their potential Service connection from mains, sump and storage tank, types and sizes of pipes, special installation in multistoried buildings. Material, types of fixtures and fitting for a contemporary bathroom– taps –quarter turn, half turn, ceramic, foam flow etc, hot water mixer, hand shower Rainwater harvesting to include roof top harvesting, type of spouts, sizes of rainwater pipes and typical detail of a water harvesting pit.

Module -2

Heat Ventilation and Air Conditioning (HVAC):
Behaviour of heat propagation, thermal insulating materials and their co-efficient of thermal conductivity. General methods of thermal insulation: Thermal insulation of roofs, exposed walls. Ventilation: Definition and necessity, system of ventilation. Principles of air conditioning, Air cooling, Different systems of ducting and distribution, Essentials of air-conditioning system.

Module -3

Electrical and Fire Fighting Services:
Electrical systems, Basics of electricity, single/Three phase supply, protective devices in electrical installation, Earthing for safety, Types of earthing, ISI Specifications. Electrical installations in buildings, Types of wires, Wiring systems and their choice, planning electrical wiring for building, Main and distribution boards, Principles of illumination.
Classification of buildings based on occupancy, causes of fire and spread of fire, Standard fire, Fire fighting, protection and fire resistance, Firefighting equipment and different methods of fighting fire., means of escape, alarms, etc., Combustibility of materials, Structural elements and fire resistance, Fire escape routes and elements, planning and design. Wet risers, dry risers, sprinklers, heat detector, smoke detectors, fire dampers, fire doors, etc. Provisions of NBC.

Module -4

Plumbing and Fire Fighting Layout of Simple Buildings:
Application of above studies in preparing layout and details - Plumbing layout of residential and public buildings, Fire fighting layout, Reflected ceiling plan of smoke detectors / sprinklers, etc.

Module -5

Engineering Services: engineering services in a building as a system, Lifts, escalators, cold and hot water systems, waste water systems and electrical systems.
Pumps and Machineries: Reciprocating, Centrifugal, Deep well, Submersible, Automatic pumps, Sewerage pumps, Compressors, Vacuum pump – their selection, installation and maintenance – Hot water boilers – Classification and types of lifts, lift codes, rules structural provision: escalators, their uses, types and sizes, safety norms to be adopted – Social features required for physically handicapped and elderly, DC/AC motors, Generators,
Building Maintenance: Preventive and protective maintenance, Scheduled and contingency maintenance planning, M.I.S. for building maintenance. Maintenance standards. Economic maintenance decisions.

Course Outcomes: After studying this course, students will be able to:

1. Describe the basics of house plumbing and waste water collection and disposal.
2. Discuss the safety and guidelines with respect to fire safety.
3. Describe the issues with respect to quantity of water, rain water harvesting and roof top harvesting.
4. Understand and implement the requirements of thermal comfort in buildings.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Reference Books:

1. National Building Code.
2. Charangith shah, Water supply and sanitary engineering, Galgotia publishers.
3. Kamala & D L Kanth Rao, Environmental Engineering, Tata McGraw Hill publishing co. Ltd.
4. Technical teachers Training Institute (Madras), Environmental Engineering, Tata McGraw Hill publishing Co. Ltd.
5. M. David Egan, Concepts in Building Fire Safety.
6. O. H. Koenigsberger, "Manual of Tropical Housing and Building", Longman Group United Kingdom.
7. V. K. Jain, Fire Safety in Building 2edition, New Age International Publishers.
8. E. G. Butcher, Smoke control in Fire-safety Design.
9. E. R. Ambrose, Heat pumps and Electric Heating, John and Wiley and Sons Inc, New York.
10. Handbook for Building Engineers in Metric systems, NBC, New Delhi.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

REINFORCED EARTH STRUCTURES

Course Code	**18CV743**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to;
1. Create an understanding of the latest technique such as reinforcing the soil;
2. Analyze the concept of RE so as to ascertain stability of RE structures;
3. Understand the different reinforcing materials that can be used efficiently in soils.
4. Understand design concepts of different RE structures including introductory concepts of Foundations resting of RE soil bed.

Module -1

Basics of Reinforced Earth Construction: Definition, Historical Background, Components, Mechanism and Concept, Advantages and Disadvantage of reinforced earth Construction, Sandwich technique for clayey soil.
Geosynthetics and Their Functions: Historical developments, Recent developments, manufacturing process woven &non-woven, Raw materials –Classification based on materials type – Metallic and Non-metallic, Natural and Man-made, Geosynthetics.
Properties and Tests on Materials Properties – Physical, Chemical, Mechanical, Hydraulic, Endurance and Degradation requirements, Testing & Evaluation of properties.

Module -2

Design of Reinforced Earth Retaining Walls: Concept of Reinforced earth retaining wall, Internal and external stability, Selection of materials, Typical design problems
Soil Nailing Techniques: Concept, Advantages & limitations of soil nailing techniques, comparison of soil nailing with reinforced soil, methods of soil nailing, Construction sequence, Components of system, Design aspects and precautions to be taken.

Module -3

Design of Reinforced Earth Foundations: Modes of failure of foundation, Determination of force induced in reinforcement ties – Location of failure surface, tension failure and pull out resistance, length of tie and its curtailment, Bearing capacity improvement in soft soils, General guidelines.

Module -4

Geosynthetics for Roads and Slopes: Roads - Applications to Temporary and Permanent roads, Role of Geosynthetic in enhancing properties of road, control of mud pumping, Enhancing properties of subgrade, Design requirements Slopes – Causes for slope failure, Improvement of slope stability with Geosynthetic, Drainage requirements, Construction technique. Simple Numerical Stability Checking Problems on Reinforced Slopes.

Module -5

Geosynthetics - filter, drain and landfills: Filter & Drain – Conventional granular filter design criteria, Geosynthetic filter design requirements, Drain and filter properties, Design criteria – soil retention, Geosynthetic permeability, anti clogging, survivability and durability (No Numerical Problems)
Landfills – Typical design of Landfills – Landfill liner & cover, EPA Guidelines, Barrier walls for existing landfills and abandoned dumps (No Numerical Problems).

Course outcomes: After studying this course, students will be able to:
1. identify, formulate reinforced earth techniques that are suitable for different soils and in different structures;
2. understand the laboratory testing concepts of Geo synthetics
3. design RE retaining structures and Soil Nailing concepts
4. Determine the load carrying capacity of Foundations resting on RE soil bed.
5. asses the use of Geo synthetics in drainage requirements and landfill designs

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.

- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Koerner. R.M, "Design with Geo synthetics", Prince Hall Publications
2. Koerner. R.M. &Wesh, J.P, "Construction and Geotechnical Engineering using synthetic fabrics", Wiley Inter Science, New York,.
3. Sivakumar Babu G. L., "An introduction to Soil Reinforcement and Geo synthetics", Universities Press, Hyderabad
4. Swami Saran, "Reinforced Soil and its Engineering Applications", I. K. International Pvt. Ltd, New Delhi
5. Venkattappa Rao, G., & Suryanarayana Raju., G. V.S, "Engineering with Geo synthetics", Tata McGraw Hill publishing Company Limited., New Delhi.

Reference Books:

1. Jones, "Earth reinforcement and Soil structure", CJEP Butterworths, London
2. Ingold, T.S. & Millar, K.S, "Geotextile Hand Book", Thomas, Telford, London.
3. Hidetoshi Octial, Shigenori Hayshi& Jen Otani, "Earth Reinforcement Practices",Vol. I, A.A. Balkema, Rotterdam
4. Bell F.G, "Ground Engineer's reference Book", Butter worths, London
5. Ingold, T.S, "Reinforced Earth", Thomas, Telford, London.
6. Sarsby R W- Editor, "Geo synthetics in Civil Engineering", Wood head Publishing Ltd & CRC Press, 2007

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

DESIGN OF HYDRAULIC STRUCTURES

Course Code	**18CV744**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

CREDITS –03

Course Learning Objectives: This course will enable students to;

1. Analyze and design gravity dams.
2. Find the cross-section of earth dam and estimate the seepage loss.
3. Design spillways and aprons for diversion works.
4. Design CD works and chose appropriate canal regulation works.

Module -1

Gravity Dams: Introduction, forces acting on dam, cause of failure, design principles, principal and shear stresses. Elementary profile and practical profile of a gravity dam. Drainage galleries, joints in gravity dams.

Module -2

Earth Dams: Introduction, causes of failure of earth dams, preliminary section, Determination of parametric line by Casagrande's method. Estimation of seepage.

Module -3

Spillways: Types, Design of Ogee spillway, Upstream and downstream profiles, Energy dissipation devices.
Diversion Headworks: Design of aprons- Bligh's and Koshla's theory, Simple Problems.

Module -4

Cross Drainage Works: Introduction, Type of C.D works, Design considerations for C.D works. Transition formula design of protection works, Design of only aqueduct.

Module -5

Canal Regulation Works: Introduction, Function of a regulator.
Canal falls: Necessity and types.
Canal outlets: Necessity and types.

Course outcomes: After studying this course, students will be able to:

1. Check the stability of gravity dams and design the dam.
2. Estimate the quantity of seepage through earth dams.
3. Design spillways and aprons for various diversion works.
4. Select particular type of canal regulation work for canal network.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. S. K. Garg, "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi.
2. Punmia and Pandey Lal, "Irrigation and Water Power Engineering" Lakshmi Publications, New Delhi.
3. K. R. Arora. "Irrigation, Water Power and Water Resources Engineering" Standard Publications, New Delhi.

Reference Books:

1. R. K. Sharma, "Text Book of Irrigation Engineering and Hydraulic Structures", Oxford and IBH, New Delhi.
2. P. N. Modi, "Irrigation, Water Resources and Water Power", Standard Book House, New Delhi.

B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VII			
URBAN TRANSPORT PLANNING			
Course Code	**18CV745**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to;

5. Understand and apply basic concepts and methods of urban transportation planning.
6. Apprise about the methods of designing, conducting and administering surveys to provide the data required for transportation planning.
7. Understand the process of developing an organized mathematical modelling approach to solve select urban transportation planning problem.
8. Excel in use of various types of models used for travel forecasting, prediction of future travel patterns.

Module -1

Urban transport planning: Urbanization, urban class groups, transportation problems and identification, impacts of transportation, urban transport system planning process, modeling techniques in planning. Urban mass transportation systems: urban transit problems, travel demand, types of transit systems, public, private, para-transit transport, mass and rapid transit systems, BRTS and Metro rails, capacity, merits and comparison of systems, coordination, types of coordination.

Module -2

Data Collection And Inventories: Collection of data – Organisation of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship.

Module -3

Trip Generation & Distribution: UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models, Trip Attraction models, Commercial Trip Rates; Trip Distribution by Growth Factor Methods. **Problems on above.**

Module -4

Trip Distribution: Gravity Models, Opportunity Models, Time Function Iteration Models. Travel demand modeling: gravity model, opportunity models, Desire line diagram. Modal split analysis. **Problems on above.**

Module -5

Traffic Assignment: Diversion Curves; Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment. Numerical problems on Traffic Assignment. Introduction to land use planning models, land use and transportation interaction.

Course outcomes: After studying this course, students will be able to:

5. Design, conduct and administer surveys to provide the data required for transportation planning.
6. Supervise the process of data collection about travel behavior and analyze the data for use in transport planning.
7. Develop and calibrate modal split, trip generation rates for specific types of land use developments.
8. Adopt the steps that are necessary to complete a long-term transportation plan.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

4. Kadiyali. L. R., ‘Traffic Engineering and Transportation Planning’, Khanna Publishers, New Delhi.
5. Hutchinson, B.G, ‘Introduction to Urban System Planning’, McGraw Hill.
6. Khisty C.J., ‘Transportation Engineering – An Introduction’ Prentice Hall.
7. Papacostas, ‘Fundamentals of Transportation Planning’, Tata McGraw Hill.

Reference Books:

3. Mayer M and Miller E, ‘Urban Transportation Planning: A decision oriented Approach’, McGraw Hill.
4. Bruton M.J., ‘Introduction to Transportation Planning’, Hutchinson of London.
5. Dicky, J.W., ‘Metropolitan Transportation Planning’, Tata McGraw Hill.

B. E. CIVIL ENGINEERING
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SEMESTER - VII

FINITE ELEMENT METHOD

Course Code	**18CV751**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to;

1. Develop analytical skills.
2. Learn principles of analysis of stress and strain.
3. Develop problem solving skills.
4. Understand the principles of FEM for one and two dimensional problems.

Module -1

Theory of elasticity concepts, Energy principles, Rayleigh - Ritz Method, Galerkin method and finite element method, steps in finite element analysis, displacement approach, stiffness matrix and boundary conditions.

Module -2

Discritisation; finite representation of infinite bodies and discritisation of very large bodies, Natural Coordinates, Shape functions; polynomial, LaGrange and Serendipity , one dimensional formulations; beam and truss with numerical examples.

Module -3

2D formulations; Constant Strain Triangle, Linear Strain Triangle, 4 and 8 noded quadrilateral elements, Numerical Evaluation of Element Stiffness -Computation of Stresses, Static Condensation of nodes, degradation technique, Axisym metric Element.

Module -4

Isopara metric concepts; is opera metric, sub parametric and super parametric elements, Jacobian transformation matrix, Stiffness Matrix of Isopara metric Elements, Numerical integration by Gaussian quadrature rule for one, two and three dimensional problems.

Module -5

Techniques to solve nonlinearities in structural systems; material, geometric and combined non linearity, incremental and iterative techniques.

Structure of computer program for FEM analysis, description of different modules, exposure to FEM softwares.

Course outcomes: The student will have the knowledge on advanced methods of analysis of structures.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Krishnamoorthy C.S., “Finite Element analysis” -Tata McGraw Hill
2. Desai C &Abel J F.," Introduction to Finite element Method" , East West Press Pvt. Ltd.,
3. Cook R D et.al. “Concepts and applications of Finite Element analysis”, John Wiley.

Reference Books:

1. Daryl L Logan, “A first course on Finite element Method”, Cengage Learning.
2. Bathe K J - “Finite Element Procedures in Engineering analysis”- Prentice Hall.

B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VII			
NUMERICAL METHODS AND APPLICATIONS			
Course Code	**18CV752**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology

Module -1

Solution of Equations and Eigen value Problems: Solution of algebraic and transcendental equations, Fixed point iteration method, Newton Raphson method, Solution of linear system of equations, Gauss elimination method, Pivoting, Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method.

Module -2

Interpolation and Approximation: Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.

Module -3

Numerical Differentiation and Integration: Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

Module -4

Initial Value Problems for Ordinary Differential Equations : Single Step methods - Taylor's series method - Euler's method - Modified Euler's method – Fourth order Runge-Kutta method for solving first order equations - Multi step methods - Milne's and Adams-Bash forth predictor corrector methods for solving first order equations.

Module -5

Boundary Value Problems in Ordinary and Partial Differential Equations:
Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

Course Outcomes: After studying this course, The students will have a clear perception of the power of numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from Industry, management and other engineering fields.

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Grewal. B.S. and Grewal. J.S., "Numerical methods in Engineering and Science", Khanna Publishers, 9th Edition, New Delhi
2. Gerald. C. F., and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6th Edition, New Delhi.

Reference Books:

1. Chapra. S.C. and Canale. R. P., "Numerical Methods for Engineers, Tata McGraw Hill, New Delhi.
2. 2. Brian Bradie. "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi.
3. Sankara Rao. K., "Numerical methods for Scientists and Engineers", Prentice Hall of India Private, New Delhi.

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SEMESTER - VII

ENVIRONMENTAL PROTECTION AND MANAGEMENT

Course Code	**18CV753**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to gain knowledge in Environmental protection and Management systems

Module -1

Environmental Management Standards: Unique Characteristics of Environmental Problems - Systems approach to Corporate environmental management - Classification of Environmental Impact Reduction Efforts - Business Charter for Sustainable Production and Consumption – Tools, Business strategy drivers and Barriers - Evolution of Environmental Stewardship. Environmental Management Principles - National policies on environment, abatement of pollution and conservation of resources - Charter on Corporate responsibility for Environmental protection.

Module -2

Environmental Management Objectives: Environmental quality objectives – Rationale of Environmental standards: Concentration and Mass standards, Effluent and stream standards, Emission and ambient standards, Minimum national standards, environmental performance evaluation: Indicators, benchmarking. Pollution control Vs Pollution Prevention - Opportunities and Barriers – Cleaner production and Clean technology, closing the loops, zero discharge technologies.

Module -3

Environmental Management System: EMAS, ISO 14000 - EMS as per ISO 14001– benefits and barriers of EMS – Concept of continual improvement and pollution prevention - environmental policy – initial environmental review – environmental aspect and impact analysis – legal and other requirements- objectives and targets – environmental management programs – structure and responsibility – training awareness and competence- communication – documentation and document control – operational control – monitoring and measurement – management review.

Module -4

Environmental Audit: Environmental management system audits as per ISO 19011- – Roles and qualifications of auditors - Environmental performance indicators and their evaluation – Non conformance – Corrective and preventive actions -compliance audits – waste audits and waste minimization planning – Environmental statement (form V) - Due diligence audit.

Module -5

Applications: Applications of EMS, Waste Audits and Pollution Prevention Control: Textile, Sugar, Pulp & Paper, Electroplating, , Tanning industry. Hazardous Wastes - Classification, characteristics Treatment and Disposal Methods, Transboundary movement, disposal.

Course outcomes: After studying this course, students will be able to:

1. Appreciate the elements of Corporate Environmental Management systems complying to international environmental management system standards.
2. Lead pollution prevention assessment team and implement waste minimization options.
3. Develop, Implement, maintain and Audit Environmental Management systems for Organizations.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Reference Books:

1. Christopher Sheldon and Mark Yoxon, “Installing Environmental management Systems – a step by step guide” Earthscan Publications Ltd, London, 1999.
2. ISO 14001/14004: Environmental management systems – Requirements and Guidelines – International

Organisation for Standardisation, 2004
3. ISO 19011: 2002, "Guidelines for quality and/or Environmental Management System auditing, Bureau of Indian Standards, New Delhi, 2002
4. Paul L Bishop „Pollution Prevention: Fundamentals and Practice, McGraw- Hill International, Boston, 2000.
5. Environmental Management Systems: An Implementation Guide for Small and Medium-Sized Organizations, Second Edition, NSF International, Ann Arbor, Michigan, January 2001.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

COMPUTER AIDED DETAILING OF STRUCTURES

Course Code	**18CVL76**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives: This course will enable students to
1. Be aware of the Scale Factors, Sections of drawings,
2. Draft the detailing of RC and Steel Structural member.

Module -1 Detailing of RCC Structures
- Beams – Simply supported, Cantilever and Continuous.
- Slab – One way, Two way and One-way continuous.
- Staircase – Doglegged
- Cantilever Retaining wall
- Counter Fort Retaining wall
- Circular Water Tank, Rectangular Water Tank.

Module -2 Detailing of Steel Structures
1. Connections – Beam to beam, Beam to Column by Bolted and Welded Connections.
2. Built-up Columns with lacings and battens
3. Column bases and Gusseted bases with bolted and welded connections.
4. Roof Truss – Welded and Bolted
5. Welded Plate girder
6. Gantry Girder

Course outcomes: After studying this course, students will be able to:
- Prepare detailed working drawings

Question paper pattern:
1. Two questions shall be asked from each Module.
2. One full question should be answered from each Module.
3. Each question carries 50 marks.

Textbooks:
1. N Krishna Raju, "Structural Design and Drawing of Reinforced Concrete and Steel", University Press
2. Krishna Murthy, "Structural Design and Drawing – Concrete Structures", CBS Publishers, New Delhi

Reference Books:
1. SP 34: Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards.
2. IS 13920, Ductile Design And Detailing Of Reinforced Concrete Structures Subjected To Seismic Forces - Code Of Practice, Bureau of Indian Standard.

B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VII			
GEOTECHNICAL ENGINEERING LABORATORY			
Course Code	**18CVL77**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives: This course will enable students to;

1. To carry out laboratory tests and to identify soil as per IS codal procedures
2. To perform laboratory tests to determine index properties of soil
3. To perform tests to determine shear strength and consolidation characteristics of soils

Modules

1. Field identification of soil, Specific gravity test (pycnometer and density bottle method).Water content determination by oven drying and Pycnometer method, rapid moisture meter method.
2. Grain size analysis
   i. Sieve analysis
   ii. Hydro meter analysis
3. In-situ density tests
   i. Core-cutter method
   ii. Sand replacement method
4. Consistency limits
   i. Liquid limit test(by Casagrande's and cone penetration method)
   ii. Plastic limit test
   iii. Shrinkage limit test
5. Standard compaction test (light and heavy compaction)
6. Co-efficient of permeability test
   i. Constant head test
   ii. Variable head test
7. Shear strength tests
   i. Unconfined compression test
   ii. Direct shear test
   iii. Triaxial test (unconsolidated undrained test only)
8. Consolidation test :To determine pre consolidation pressure only(half an hour per loading-test).
9. Laboratory vane shear test
10. Demonstration of Swell pressure test, Standard penetration test and boring equipment

Course outcomes: Students will be able to conduct appropriate laboratory/field experiments and interpret the results to determine

1. Physical and index properties of the soil
2. Classify based on index properties and field identification
3. To determine OMC and MDD, plan and assess field compaction program
4. Shearstrengthandconsolidationparameterstoassessstrengthanddeformationcharacteristics
5. In-situshear strength characteristics(SPT-Demonstration)

Question paper pattern:

- All experiments are to be included in the examination except demonstration exercises.
- Candidate to perform experiment assigned to him.
- Marks are to be allotted as per the split up of marks shown on the cover page of answer script.

Reference Books:

1. Punmia B C, Soil Mechanics and Foundation Engineering-(2017),16th Edition, Laxmi Publications co., New Delhi.
2. Lambe T.W., “Soil Testing for Engineers”, Wiley Eastern Ltd., New Delhi.
3. Head K.H., “Manual of Soil Laboratory Testing” Vol. I, II, III, Princeton Press
4. BowlesJ.E.,“EngineeringPropertiesofSoilandTheirMeasurements”,-McGrawHillBookCo.NewYork.
5. Relevant BIS Codes of Practice: IS-2720 series

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VIII

DESIGN OF PRE-STRESSECONCRETE

Course Code	**18CV81**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to learn Design of Pre Stressed Concrete Elements.

Module -1

Introduction and Analysis of Members: Concept of Pre stressing - Types of Pre stressing - Advantages - Limitations –Pre stressing systems - Anchoring devices - Materials - Mechanical Properties of high strength concrete - high strength steel - Stress-Strain curve for High strength concrete.
Analysis of members at transfer - Stress concept - Comparison of behavior of reinforced concrete – pre stressed concrete - Force concept - Load balancing concept - Kern point -Pressure line.

Module -2

Losses in Pre stress: Loss of Pre stress due to Elastic shortening, Friction, Anchorage slip, Creep of concrete, Shrinkage of concrete and Relaxation of steel - Total Loss.
Deflection and Crack Width Calculations of Deflection due to gravity loads - Deflection due to prestressing force -Total deflection - Limits of deflection - Limits of span-to-effective depth ratio -Calculation of Crack Width - Limits of crack width.

Module -3

Design of Sections for Flexure: Analysis of members at ultimate strength - Preliminary Design - Final Design for Type 1members.

Module -4

Design for Shear: Analysis for shear - Components of shear resistance - Modes of Failure - Limit State of collapse for shear - Design of transverse reinforcement.

Module -5

Different anchorage system and design of end block by latest IS codes.

Course outcomes: After studying this course, students will be able to:

1. Understand the requirement of PSC members for present scenario.
2. Analyse the stresses encountered in PSC element during transfer and at working.
3. Understand the effectiveness of the design of PSC after studying losses
4. Capable of analyzing the PSC element and finding its efficiency.
5. Design PSC beam for different requirements.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Krishna Raju, N. “Pre stressed Concrete”, Tata McGraw Hill Publishing Company, New Delhi 2006
2. Krishna Raju. N., “Pre-stressed Concrete - Problems and Solutions”, CBS Publishers and Distributors, Pvt. Ltd., New Delhi.
3. Rajagopalan N, “Pre - stressed Concrete”, Narosa Publishing House, New Delhi

Reference Books:

1. Praveen Nagarajan, “Advanced Concrete Design”, Person Publishers
2. P. Dayaratnam, “Pre stressed Concrete Structures”, Scientific International Pvt. Ltd.
3. Lin T Y and Burns N H, ‘Design of Pre - stressed Concrete Structures’ , John Wiley and Sons, New York
4. Pundit G S and Gupta S P, “Pre - stressed Concrete”, C B S Publishers, New Delhi
5. IS: 1343: Indian Standard code of practice for Pre stressed concrete, BIS, New Delhi.
6. IS: 3370-Indian Standard code of practice for concrete structures for storage of liquids, BIS, New Delhi.

B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VIII			
BRIDGE ENGINEERING			
Course Code	**18CV821**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to understand the analysis and design of concrete Bridges.

Note: All designs have to be done by Working Stress Method

Module -1

Introduction to bridges, classification, selection of bridge site and preliminary and detailed survey work computation of discharge, linear waterway, economic span, afflux, scour depth.

Design loads for bridges, introduction to I.R.C. loading standards, Load Distribution Theory, Bridge slabs, Effective width, Introduction to methods as per I.R.C.

Module -2

Design of Slab Bridges: Straight and skew slab bridges.

Module -3

Design of T beam bridges(up to three girder only)

Proportioning of components, analysis of slab using IRC Class AA tracked vehicle, structural design of slab, analysis of cross girder for dead load & IRC Class AA tracked vehicle, structural design of cross girder, analysis of main girder using Courbon's method, calculation of dead load BM and SF, calculation of live load B M & S F using IRC Class AA Tracked vehicle. Structural design of main girder.

Module -4

Other Bridges:

Design of Box culvert (Single vent only).

Design of Pipe culverts.

Module -5

Substructures - Design of Piers and abutments,

Introduction to Bridge bearings, Hinges and Expansion joints.(No design).

Course outcomes: After studying this course, students will be able to:

1. Understand the load distribution and IRC standards.
2. Design the slab and T beam bridges.
3. Design Box culvert, pipe culvert
4. Use bearings, hinges and expansion joints and
5. Design Piers and abutments.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Johnson Victor. D, "Essentials of Bridge Engineering", Oxford Publishing Company.
2. N Krishna Raju, "Design of Bridges, Oxford and IBH publishing company
3. T R Jagadeesh and M A Jayaram, "Design of bridge structures", Prentice Hall of India

Reference Books:

1. Jain and Jaikrishna, "Plain and Reinforced Concrete", Vol.2.,Nem Chand Brothers.
2. Standard specifications and code of practice for road bridges, IRC section I,II, III and IV.
3. "Concrete Bridges", The Concrete Association of India

B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VIII			
PREFABRICATED STRUCTURES			
Course Code	**18CV822**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Understand modular construction, industrialized construction
2. Design prefabricated elements.
3. Understand construction methods.

Module -1

Introduction: Need for prefabrication–Principles–Materials–Modular coordination–Standarization–Systems–Production–Transportation–Erection.

Module -2

Prefabricated Components: Behavior of structural components–Large panel constructions–Construction of roof and floor slabs–Wall panels–Columns–Shear walls.

Module -3

Design Principles: Disuniting of structures-Design of cross section based on efficiency of material used–Problems in design because of joint flexibility–Allowance for joint deformation.

Module -4

Joint In Structural Members: Joints for different structural connections–Dimensions and detailing–Design of expansion joints.

Module -5

Design For Abnormal Loads: Progressive collapse–Code provisions–Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc.,-Importance of avoidance of progressive collapse.

Course Outcomes: After studying this course, students will be able to:

1. Use modular construction, industrialized construction
2. Design prefabricated elements
3. Design some of the prefabricated elements
4. Use the knowledge of the construction methods and prefabricated elements in buildings

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. CBRI, Building materials and components, India, 1990
2. Gerostiza C.Z., Hendrikson C. and Rehat D.R.," Knowledge based process planning for construction and manufacturing", Academic Press Inc., 1994

Reference Books:

1. KonczT.,"Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH,1976.
2. "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland BetorVerlag, 2009

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VIII

ADVANCED FOUNDATION ENGINEERING

Course Code	**18CV823**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Gain knowledge of about advanced topics of foundation design and analyses, supplementing their comprehensive knowledge acquired in basic foundation engineering course.
2. Develop profound understanding of shallow and deep foundation analyses.
3. Develop understanding of choice of foundation design parameters.
4. Learn about cause and effect of dynamic loads on foundation.

Module -1

General bearing capacity equation – Terzaghi's, Brinch Hansen's and Mayerhof's analyses, bearing capacity of footings according to BIS, eccentrically loaded footing, footing on layered soil, Settlement of shallow Foundations: Immediate, consolidation, & differential settlements. Principles of design of footing, Proportioning of footings for equal settlement.

Module -2

Design of combined footings by Rigid method, Combined footings (rectangular & trapezoidal), strap footings. Types of rafts, bearing capacity & settlements of raft foundation, Design of raft foundation – Conventional rigid method, Elastic methods, Coefficient of sub-grade reaction, IS code (IS-2950) procedure.

Module -3

Introduction Necessity of pile foundations, Classification, Load bearing capacity of single pile by Static formula, Dynamic formula, Pile load test and Penetration tests. Introduction, Pile groups, group action of piles in sand and clay, group efficiency of piles, settlement of piles, negative skin friction, laterally loaded piles and under reamed piles.

Module -4

Well Foundations: Introduction, Different shapes and characteristics of wells. Components of well foundation. Forces acting on well foundation. Sinking of wells. Causes and remedies of tilts and shifts.
Drilled Piers & Caissons: Introduction, construction, advantages and disadvantages of drilled piers. Design of open, pneumatic and floating caissons. Advantages and disadvantages of floating caissons.

Module -5

Machine Foundations: Introduction, free and forced vibrations, Types of Machine foundations, degrees of freedom of a block foundation, general criteria for design of machine foundation, vibration analysis of a machine foundation, determination of natural frequency, vibration isolation and control.

Course outcomes: After studying this course, students will be able to:

1. Estimate the size of isolated and combined foundations to satisfy bearing capacity and settlement criteria.
2. Estimate the load carrying capacity and settlement of single piles and pile groups including laterally loaded piles.
3. Understand the basics of analysis and design principles of well foundation, drilled piers and caissons.
4. Understand basics of analysis and design principles of machine foundations.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Punmia B.C., "Soil Mechanics and Foundation Engineering,Laxmi Publications Co., India.
2. Donald P. Coduto, "Geotechnical Engineering Principles & Practices", Prentice-hall of India Ltd, India.
3. Murthy V.N.S., "Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering", CRC Press, New York.

Reference Books:
1. Bowles J.E., “Foundation Analysis and Design”, McGraw Hill Pub. Co. New York. 2. Swami Saran, “Analysis and Design of Substructures”, Oxford & IBH Pub. Co. Pvt. Ltd., India. 3. R.B. Peck, W.E. Hanson & T.H. Thornburn, “Foundation Engineering”, Wiley Eastern Ltd., India. 4. Braja, M. Das, “Principles of Geotechnical Engineering”, Cengage Learning, India. 5. Bureau of Indian Standards: IS-1904, IS-6403, IS-8009, IS-2950, IS-2911 and all other relevant codes.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VIII

REHABILITATION AND RETROFITTING

Course Code	**18CV824**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to;

1. Investigate the cause of deterioration of concrete structures.
2. Strategies different repair and rehabilitation of structures.
3. Evaluate the performance of the materials for repair.

Module -1

General: Introduction and Definition for Repair, Retrofitting, Strengthening and rehabilitation. Physical and Chemical Causes of deterioration of concrete structures, Evaluation of structural damages to the concrete structural elements due to earthquake.

Module -2

Damage Assessment: Purpose of assessment, Rapid assessment, Investigation of damage, Evaluation of surface and structural cracks, Damage assessment procedure, destructive, non-destructive and semi destructive testing systems.

Module -3

Influence on Serviceability and Durability: Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection.

Module -4

Maintenance and Retrofitting Techniques: Definitions: Maintenance, Facts of Maintenance and importance of Maintenance Need for retrofitting, retrofitting of structural members i.e., column and beams by Jacketing technique, Externally bonding(ERB) technique, near surface mounted (NSM) technique, External post-tensioning, Section enlargement and guidelines for seismic rehabilitation of existing building.

Module -5

Materials for Repair and Retrofitting: Artificial fiber reinforced polymer like CFRP, GFRP, AFRP and natural fiber like Sisal and Jute. Adhesive like, Epoxy Resin, Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning.

Course outcomes: After studying this course, students will be able to:

1. Identify the causes for structural (Concrete) deterioration.
2. Assess the type and extent of damage and carry out damage assessment of structures through various types of tests.
3. Recommend maintenance requirements of the buildings and preventive measures against influencing factors.
4. Select suitable material and suggest an appropriate method for repair and rehabilitation.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Sidney, M. Johnson, “Deterioration, Maintenance and Repair of Structures”
2. Denison Campbell, Allen & Harold Roper, “Concrete Structures – Materials, Maintenance and Repair”- Longman Scientific and Technical.

Reference Books:

1. R.T.Allen and S.C. Edwards, “Repair of Concrete Structures”-Blakie and Sons
2. Raiker R.N., “Learning for failure from Deficiencies in Design, Construction and Service”- R&D Center (SDCPL).
3. CPWD Manual

B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VIII			
PAVEMENT DESIGN			
Course Code	**18CV825**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Gain knowledge about the process of collecting data required for design, factors affecting pavement design, and maintenance of pavement.
2. Excel in the path of analysis of stress, strain and deflection in pavement.
3. Understand design concepts of flexible pavement by various methods (CBR, IRC 37-2001, Mcleods, Kansas) and also the same of rigid pavement by IRC 58-2002
4. Understand the various causes leading to failure of pavement and remedies for the same.
5. Develop skills to perform functional and structural evaluation of pavement by suitable methods.

Module -1

Introduction: Desirable characteristics of pavement, Types and components, Difference between Highway pavement and Air field pavement, Design strategies of variables, Functions of sub grade, sub base, Base course, surface course, comparison between Rigid and flexible pavement

Fundamentals of Design of Pavements: Stresses and deflections, Principle, Assumptions and Limitations of Boussinesq's theory, Burmister theory and problems on above.

Module -2

Design Factors: Design wheel load, contact pressure, Design life, Traffic factors, climatic factors, Road geometry, Subgrade strength and drainage, ESWL concept Determination of ESWL by equivalent deflection criteria, Stress criteria, EWL concept, and problems on above.

Flexible pavement Design: Assumptions, Mcleod Method, Kansas method, CBR method, IRC Method (old), CSA method using IRC-37-2001, problems on above.

Module -3

Flexible Pavement Failures, Maintenance and Evaluation: Types of failures, Causes, Remedial/Maintenance measures in flexible pavements, Functional Evaluation by Visual inspection and unevenness measurements, Structural evaluation by Benkleman beam deflection method, Falling weight deflecto meter, GPR method. Design factors for runway pavements, Design methods for

Airfield pavement and problems on above.

Module -4

Stresses in Rigid Pavement : Types of stress, Analysis of Stresses, Westergaard's Analysis, Modified Westergaard equations, Critical stresses, Wheel load stresses, Warping stress, Frictional stress, combined stresses (using chart / equations), problems on above.

Design of Rigid Pavement: Design of CC pavement by IRC: 58-2002 for dual and Tandem axle load, Reinforcement in slabs, Design of Dowel bars, Design of Tie bars, Design factors for Runway pavements, Design methods for airfield pavements, problems of the above.

Module -5

Rigid Pavement Failures, Maintenance and Evaluation: Types of failures, causes, remedial/maintenance measures in rigid pavements, Functional evaluation by Visual inspection and unevenness measurements, wheel load and its repetition, properties of sub grade, properties of concrete. External conditions, joints, Reinforcement, Requirements of joints, Types of joints, Expansion joint, contraction joint, warping joint, construction joint, longitudinal joint, Design of joints.

Course outcomes: After studying this course, students will be able to:

1. Systematically generate and compile required data's for design of pavement (Highway & Airfield).
2. Analyze stress, strain and deflection by boussinesq's, bur mister's and westergaard's theory.
3. Design rigid pavement and flexible pavement conforming to IRC58-2002 and IRC37-2001.
4. Evaluate the performance of the pavement and also develops maintenance statement based on site specific requirements.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.

- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. S K Khanna, C E G Justo, and A Veeraragavan, "Highway Engineering", Nem Chand & Brothers
2. L.R.Kadiyali and Dr.N.B.Lal, " Principles and Practices of Highway Engineering", Khanna publishers
3. Yang H. Huang , "Pavement Analysis and Design", University of Kentucky.

Reference Books:

1. Yoder & wit zorac, "Principles of pavement design", John Wiley & Sons.
2. SubhaRao, "Principles of Pavement Design".
3. R Srinivasa Kumar, "Pavement Design", University Press.
4. Relevant recent IRC codes

B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VIII			
PROJECT WORK PHASE-2			
Course Code	**18CVP83**	CIE Marks	40
Teaching Hours/Week(L:T:P)	**-**	SEE Marks	60
Credits	08	Exam Hours	03

Course objectives:

- To support independent learning.
- To develop interactive, communication, organization, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgment, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instill responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Project Work Phase - II: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.

Course outcomes: At the end of the course the student will be able to:

- Describe the project and be able to defend it.
- Develop critical thinking and problem solving skills.
- Learn to use modern tools and techniques.
- Communicate effectively and to present ideas clearly and coherently both in written and oral forms.
- Develop skills to work in a team to achieve common goal.
- Develop skills of project management and finance.
- Develop skills of self learning, evaluate their learning and take appropriate actions to improve it.
- Prepare them for life-long learning to face the challenges and support the technological changes to meet the societal needs.

Evaluation Procedure:

- **As per University guidelines**
- **Internal Marks:** The Internal marks (100 marks) evaluation shall be based on Phase wise completion of the project work, Project report, Presentation and Demonstration of the actual/model/prototype of the project.
- **Semester End Examination:** SEE marks for the project (100 marks) shall be based on Project report, Presentation and Demonstration of the actual/model/prototype of the project, as per the University norms by the examiners appointed VTU.

B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VIII			
TECHNICAL SEMINAR			
Course Code	**18CVS84**	CIE Marks	100
Teaching Hours/Week(L:T:P)	**--**	SEE Marks	**--**
Credits	01	Exam Hours	03

Course Learning Objectives:
The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas. Each student, under the guidance of a Faculty, is required to choose, preferably, a recent topic of his/her interest relevant to the course of specialization. Carryout literature survey; organize the Course topics in a systematic order.

- Conduct literature survey in the domain area to find appropriate topic.
- Prepare the synopsis report with own sentences in a standard format.
- Learn to use MS word, MS power point, MS equation and Drawing tools or any such facilities in the preparation of report and presentation.
- Present the seminar topic orally and/or through power point slides.
- Communicate effectively to answer the queries and involve in debate/discussion.
- The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Course Outcomes: At the end of the course the student will be able to:

- Develop knowledge in the field of Civil Engineering and other disciplines through independent learning and collaborative study.
- Identify and discuss the current, real-time issues and challenges in engineering & technology.
- Develop written and oral communication skills.
- Explore concepts in larger diverse social and academic contexts.
- Apply principles of ethics and respect in interaction with others.
- Develop the skills to enable life-long learning.

Evaluation Procedure:

- As per University guidelines.
- The Internal Assessment marks for the seminar shall be awarded based on the relevance of the seminar topic, quality of the report, presentation skills, participation in the question and answer, and attendance in the seminar classes/sessions.

<table>
<tr><td colspan="4" align="center">B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VIII</td></tr>
<tr><td colspan="4" align="center">INTERNSHIP /PROFESSIONAL PRACTICE</td></tr>
<tr><td>Course Code</td><td>18CVI85</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Teaching Hours/Week(L:T:P)</td><td>Industry Oriented</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Credits</td><td>03</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td colspan="4">Course Learning Objectives: This course will enable students to get the field exposure and experience</td></tr>
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Note: Internship /Professional Practice:

1. This shall be carried out by students in industry set-up related to the construction/ materials testing laboratories/research organizations/project management consulting firms/QS and QA organizations/ planning and design offices/Professional organizations like ACCE/ICI/INSTRUCT/RMCMA/QCI, PMI, CIDC etc. and other avenues related to the civil engineering domain in consultation and approval of internship guide/HOD /internship committees of the institutions.
2. The professional certification programs like ACCE(I)- SMP, ICI-BMTPC certifications, NSTRUCT-certifications, CIDC certifications, RMC-QCI's RMCPCS Certification Programs, RMCMA-NRMCA'S Concrete Technologist India(CTI) programs and such similar programs by professional bodies with adequate industry exposures at sites/RMC plants can be considered as Internship /Professional Practice with due approvals from the guide/HOD /internship committees of the institutions
3. The industry/organization should issue certificates of internship offer and its completion. The offer letter should clearly have the nature of work to be done by the student and the supervisor's name and duration of internship.
4. The student shall make a midterm and final presentation of the activities undertaken during the first 6 weeks and at the end of 12th week of internship respectively, to a panel comprising internship guide, a senior faculty from the department and head of the department. Each student should submit the internship report at the end of semester with internship certificate.
5. Viva-Voce examination shall be conducted by a panel of examiners consisting of internship supervisor from industry or industry professional approved by university and internship guide from the institute.
6. The College shall facilitate and monitor the student internship program.
7. The internship should be completed during vacation after VI and VII semesters.

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Semester III

SL	Couse category	Course Code	Course	BOS / Teaching Department	BOE / Paper Setting Board	Teaching Hours per Week			Credits	Duration of Exam	Marks		
						L	T	P			CIE	SEE	Total
01	BSC	21MCS31	Maths-3	Mathematics	Mathematics	3	0	0	3	3	50	50	100
02	IPCC	21CS32	Object Oriented Concepts	Concerned Department	Concerned Department	3	0	2	4	3	50	50	100
03	PCC	21CS33	Data Structures and Applications	Concerned Department	Concerned Department	3	0	0	3	3	50	50	100
04	PCC	21CS34	Digital Systems Design and Computer Organization	Concerned Department	Concerned Department	3	0	0	3	3	50	50	100
05	PCC	21CSL35	Data Structures and Applications Lab	Concerned Department	Concerned Department	0	0	2	1	3	50	50	100
06	PCC	21CSL36	Digital Lab	Concerned Department	Concerned Department	0	0	2	1	3	50	50	100
07	HS	21KSK37/47	Samskrutika Kannada	Humanities	Humanities	1	0	0	1	-	100	----	100
		21KBK37/47	Balake Kannada										
		OR								2	50	50	
	HS	21CIP37/47	Constitution of India, professional Ethics and Cyber Law										
08	AEC	21ACS38	Unix and Shell Programming	Concerned Department	Concerned Board	1	0	0	1	2	50	50	100
09	AEC	21DTI39	Ability Enhancement Course (Design Thinking and social innovation)	Concerned Department	Concerned Board	1	0	0	1	2	50	50	100
			Total						**18**		**500/ 450**	**400/ 450**	**900**
Course prescribed to lateral entry Diploma holders admitted to III semester B.E. Program													
10	NCMC	21MATDIP31	Additional Mathematics - I	Mathematics	-	3	0	0	0	-	100	-	100

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical of the same course. Credits for IPCC are 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Semester IV

SL	Course category	Course Code	Course	BOS / Teaching Department	BOE / Paper Setting Board	Teaching Hours per Week L	T	P	Credits	Duration of Exam	Marks CIE	SEE	Total
01	BSC	21MCS41	Maths-4	Mathematics	Mathematics	3	0	0	3	3	50	50	100
02	IPCC	21CS42	Software Engineering	Concerned Department	Concerned Department	3	0	2	4	3	50	50	100
03	PCC	21CS43	Design And Analysis Of Algorithms	Concerned Department	Concerned Department	3	0	0	3	3	50	50	100
04	PCC	21CS44	Microcontroller And Embedded Systems	Concerned Department	Concerned Department	3	0	0	3	3	50	50	100
05	PCC	21CSL45	Design And Analysis Of Algorithms Lab	Concerned Department	Concerned Department	0	0	2	1	3	50	50	100
06	PCC	21CSL46	Microcontroller and Embedded Systems Lab	Concerned Department	Concerned Department	0	0	2	1	3	50	50	100
07	HS	21KSK37/47	Samskrutika Kannada	HSMC	HSMC	1	0	0	1	--	100	---	100
		21KBK37/47	Balake Kannada										
		OR											
	HS	21CIP37/47	Constitution of India, professional Ethics and Cyber Law							2	50	50	
08	AEC	21SSA480	Soft skills and basic aptitude	Humanities	Humanities	1	2	0	2	2	50	50	100
09	AEC	21ACS48X	Biology for engineers / **Department specific Ability Enhancement Course**	Chemistry/ Physics/ Concerned Department	Concerned Board	0 For AEC as lab course 1 For AEC as theory course	0 0	2 0	1	2	50	50	100
10	UHV	21UHV490	Universal Human Values			1	0	0	1	2	50	50	100
11	INT	21INT491	Internship - I	Evaluation By the appropriate authorities		Completed during the intervening period of II and III semesters. Lateral entry students have to attend the			2	----	100	--	100
	Total								22		600/ 650	500 450	1100
Course prescribed to lateral entry Diploma holders admitted to III semester B.E. Program													
12	NCMC	21MATDIP41	Additional Mathematics - I	Mathematics	-	3	0	0	0	-	100	-	100

Ability Enhancement Course

01	21ABE481	Biology for Engineers
02	21ACS482	**R** Programming
03	21ACS483	Web Designing

Internship - I (21INT491): All the students admitted to engineering programmes shall have to undergo a mandatory internship-I of 03 weeks during the intervening vacation of II and III semesters. All the students admitted to engineering programs under the lateral entry category shall have to undergo a mandatory internship-I of 03 weeks during the intervening period of III and IV semesters. Internship-I shall include Inter / Intra Institutional activities. A Viva-voce examination (Presentation followed by question-answer session) shall be conducted during IV semester. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequent examinations after satisfying the internship requirements The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the IV semester grade card.

Semester: III

Course Name: **FOURIER TRANSFORM, NUMERICAL METHODS AND DISCRETE MATHEMATICAL STRUCTURES**

Course Code	21MCS31	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	03

Pre-requisite(s):
1. Integration by parts using Bernolli's rule.
2. First order Ordinary Differential Equations.
3. Propositions, construction of truth tables for different logical connectives.
4. Definition of set, operations on sets.
5. Definitions of different types of functions.

Module – 1

Infinite Fourier Transforms: Infinite Fourier transforms, definition, Fourier Sine and Cosine transforms. Inverse Fourier transforms, Inverse Fourier Cosine and Sine transforms and Problems.
Self- Study: Leibnitz rule for differentiation under integral sign.
8 Hours

Module - 2

Numerical Solution of first-Order ODEs
Taylor's series method, Modified Euler's method, Runge-Kutta method of order four, Milne's predictor and corrector formula, Adam's–Bashforth formula. (all methods without Derivations)
Self -Study: Solution of ODE using Picard's method.
8 Hours

Module – 3

Logical connectives: Disjunction**,** Conjunction, Negation, Exclusive Disjunction. Conditional and Bi-conditional statements. Laws of logic, Tautologies and contradictions, Logical Equivalence, Duality, Converse, inverse and contra positive. Rules of inference, open statements and Quantifiers.
Self- Study: Logical gates.
8 Hours

Module – 4

Relations: Definition of a relation, Matrix of a relation, Diagraph of a relation. Union/intersection of relations. Complement of a relation. Connectivity relation, inverse of a relation, composition of a relation. Properties of relation. Equivalence relation (Theorems on Equivalence Relations). Partial ordered relation and poset. Least upper bound and greatest lower bound. Extremal elements of a poset, Hasse diagram.
Self - Study: Lattices.
8 Hours

Module – 5

Functions and Recurrence relations: Compositions of functions (Theorems on Composition functions), Invertible functions (Theorems on Invertible functions). Permutation functions. Recurrence relations. First order recurrence relation, Second order homogeneous recurrence relation, higher order linear homogeneous recurrence relation, Non-homogeneous recurrence relations.

Self -Study: Generating functions.

8 Hours

Course Outcomes: Upon completion of this course, student will be able to:

1. Demonstrate the Fourier transform to study the behavior of periodic functions and their applications in system communications, Analysis and design of algorithms.
2. Solve first order ODE's arising in engineering problems using single step numerical methods.
3. Apply the concepts of logic for effective computation and relating problems in the Engineering domain.
4. Analyze the concepts of relations to various fields of Engineering.
5. Apply the concepts of functions and recurrence relations in the context of various fields of Computer Science Engineering, like, Database, finite Automata and formal languages, Compilers etc.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	44th Edition ,2017
2	Advanced Engineering Mathematics	Erwin Kreyszig.	Wiley Publications	10th Edition,2011
3	Foundation of Discrete Mathematics	K D Joshi	New Age Publishers, Ltd	10th Edition, 2014
4	Discrete and Combinatorial Mathematics	Ralph P. Grimaldi	Pearson Education Inc.	5th Edition, 2011.
Reference Books				
1	Higher Engineering Mathematics	B.V Ramana	Tata McGraw-Hill,	11th Edition, 2010.
2	Discrete Mathematics and its applications	Kenneth H. Rosen	Tata McGraw-Hill,	7th Edition,2012
3	Discrete Mathematical Structures: Theory and Applications	D. S. Malik, M. K. Sen	Thomson Course Technology	1st Edition, 2004.
4	Discrete Mathematical structures	Dr. D.S. Chandrasekharaiah.	Prism Books Pvt Ltd	6th Edition, 2019.

Semester: III

Course Name: OBJECT ORIENTED PROGRAMMING USING JAVA

Course Code	21CS32	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	50
Total Hours of Pedagogy	40T+20P	Total Marks	100
Credits	4	Exam Hours	03

Pre-requisites:

Students should know the basic knowledge of:

- C Programming

NOTE: Department shall organize bridge course on C++.

Module – 1

Introduction to Java: Java magic: The Byte code; Java Development Kit (JDK); the Java Buzzwords, Object-oriented programming; Simple Java programs. Data types, variables, arrays, Operators and Control Statements.

Text book 1: Chapter – 1, 2, 3, 4, 5

8 Hours

Module - 2

Classes, Inheritance, Exception Handling: Classes: Classes fundamentals; Declaring objects; Constructors, this keyword, garbage collection**. Inheritance**: inheritance basics, using super, creating multilevel hierarchy, method overriding. **Exception handling**: Exception handling in Java.

Text book 1: Chapter – 6, 8, 10

8 Hours

Module – 3

Packages and Interfaces: Packages, Access Protection, Importing Packages. Interfaces. **Multithreaded Programming:** Multithreaded Programming: What are threads? How to make the classes threadable; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, producer consumer problems.

Text book 1: Chapter – 9, 11

8 Hours

Module – 4

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

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

Text book 1: Chapter – 23, 30

8 Hours

Module – 5

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

Text book 2: Chapter – 5, 6

8 Hours

Course Outcomes:

1. Analyze the necessity of object oriented programming paradigm over structured programming.
2. Develop reusable programs using the concepts of inheritance, polymorphism and Exception handling to develop efficient and error free code.
3. Apply the concepts of Multithreading to develop programs in Java.
4. Apply the concepts of Java Swings to develop robust programs.
5. Design and develop Java Programs using backend tools.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Java The Complete Reference	Herbert Schildt	Tata McGraw Hill	8th Edition ,2015
2	J2EE - The Complete Reference	Jim Keogh	Tata McGraw Hill	2007
Reference Books				
1	Introduction to Java programming	Y. Daniel Liang	Pearson education	12th edition
2	Java How to Program, Early Objects	Paul J. Deitel, Harvey Deitel	Pearson	11th Edition,2017
3	Head first java	O'Reilly		4^{th} edition,2016

Semester: III

Course Name: **DATA STRUCTURES AND APPLICATIONS**

Course Code	21CS33	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	03

Pre-requisites: Should have a basic knowledge of C Programming.

Module – 1

Review of C Language: Arrays**,** Structures & Unions, Pointers and Dynamic memory allocation
Introduction to Data Structures: Data Structures, Classifications of Data Structures, Data structure operations: Traversing, inserting, deleting, searching and sorting.
Applications: Representation of Polynomials and Sparse Matrices with arrays

8 Hours

Module - 2

Stacks: Stack, Stack Operations, Array Representation of Stacks, Different types of expression: Infix, Postfix and Prefix.
Stack Applications: Infix to postfix conversion, Infix to prefix conversion, Evaluation of postfix expression, Recursion.
Queues: Queue, Array Representation of Queues, Queue Operations, Circular Queues, Queues and Circular queues using Dynamic arrays, Dequeues, Priority Queues.

8 Hours

Module – 3

Linked Lists: Linked List, classification of linked lists. Representation of different types of linked lists in Memory, Traversing, Insertion, Deletion, Searching, Sorting and Concatenation Operations on Singly linked list, Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues.
Applications of Linked lists – Polynomials, Sparse matrix representation.

8 Hours]

Module – 4

Trees 1: Terminologies, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; Threaded binary trees
Binary Search Trees: Binary Search Trees, Insertion, Deletion, Traversal and Searching operations on Binary search tree. Application of Trees: - Evaluation of Expression.

8 Hours

Module – 5

Trees 2: AVL tree, Red-black tree, Splay tree, B-tree.
Graphs: Terminologies, Matrix and Adjacency List Representation of Graphs, Traversal methods: Breadth First Search and Depth First Search.
Hashing: Hash Table organizations, Hashing Functions, Static and Dynamic Hashing.

8 Hours

Course Outcomes:
1. Identify types of data structures and use them to solve problems
2. Demonstrate the applications of various data structures
3. Apply the data structures to solve problems.
4. Compare solutions of a given problem using different data structures
5. Choose appropriate data structures to solve real world problems

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Data Structures: A Pseudo-code approach with C	Gilberg and Forouzan	Cengage Learning	2nd Ed, 2014
2	Fundamentals of Data Structures in C	Ellis Horowitz and Sartaj Sahni	Universities Press	2nd Ed, 2014
Reference Books				
1	Data Structures using C	Reema Thareja	Oxford press	3rd Ed 2012
2	Data Structures using C	A M Tenenbaum	PHI	2001

Semester: III

Course Name: DIGITAL SYSTEM SDESIGN AND COMPUTER ORGANIZATION

Course Code	21CS34	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	03

Pre-requisites:

1. Basic electronics
2. Basic structure of computer.

Module – 1

Karnaugh maps: minimum forms of switching functions, two and three variable Karnaugh maps, four variable Karnaugh maps, determination of minimum expressions using essential prime implicants, **Quine- McCuskey Method:** determination of prime implicants, the prime implicant chart, simplification using map-entered variables

Textbook 1: Part B: Chapter 5 (5.1 to 5.4) Chapter 6 (6.1, 6.2 and 6.5)

8 Hours

Module - 2

Multiplexers, Decoders and Programmable Logic Devices: Multiplexers, three state buffers, decoders and encoders, Programmable Logic devices.
Latches and Flip-Flops: Set Reset Latch, Gated Latches, Edge-Triggered D Flip Flop, SR Flip Flop, J K Flip Flop, T Flip Flop.
Textbook 1: Part B: Chapter 9 (Sections 9.1 to 9.4, 9.6)
Textbook 1: Part B: Chapter 11 (Sections 11.1 to 11.7)

8 Hours

Module – 3

Register and counters: Register and register transfers, Shift registers
Counters: design of Binary counters, counters for other sequences, counter design using SR and J K Flip Flops. Sequential parity checker

Textbook 1: Part B: Chapter 12 (12.1 - 12.5), Chapter 13 (13.1)

8 Hours

Module – 4

Basic Structure of Computers: Basic Operational Concepts, Bus Structures, Performance–Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement.
Machine Instructions and Programs: Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes

Textbook 2: Chapter1 – 1.3, 1.4, 1.6 (1.6.1-1.6.4, 1.6.7), Chapter 2 – (2.2 to 2.5)

8 Hours

Module – 5

Input/output Organization: Accessing I/O Devices, Interrupts, Direct Memory Access Arithmetic: Numbers, Arithmetic Operations and Characters, Addition and Subtraction of

Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-Operand Multiplication: Booth algorithm.

Textbook 2: Chapter 4 - (4.1, 4.2, 4.4)
Textbook 2: Chapter 2 - (2.1), Chapter 6 (6.1 to 6.4)

8 Hours

Course Outcomes:
1. Apply different simplifying techniques in the design of combinational circuits.
2. Design various combinational and sequential digital circuits.
3. Design various counters using Flip-Flops.
4. Describe the fundamentals of computer organization with machine instructions.
5. Elaborate the communication of input/output devices with computer system and solve arithmetic operations using various techniques.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Analog and Digital Electronics	Charles H Roth and Larry L Kinney	Cengage Learning	2019
2	Computer Organization	Carl Hamacher, Zvonko Vranesic, Safwat Zaky	Tata McGraw Hill	5th Edition 2002
Reference Books				
1	Digital Principles and Applications,	Donald P Leach, Albert Paul Malvino & Goutam Saha	Tata McGraw Hill,	8th Edition 2015.
2	Computer Organization &Architecture, Pearson	William Stallings		9th Edition

Semester: III

Course Name: DATA STRUCTURES AND APPLICATIONS LAB

Course Code	21CSL35	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total Hours of Pedagogy	20	Total Marks	100
Credits	1	Exam Hours	03

List of Experiments:

Identify the functional requirements, then Design and Develop solutions to the following list of problems

SN	Experiments
1	Design, Develop and Implement a menu driven Program in C Language for the following array operations. a. Creating an array of N Integer Elements b. Display of array Elements with Suitable Headings c. Inserting an Element (ELEM) at a given valid Position (POS) d. Deleting an Element at a given valid Position (POS) e. Exit. Support the program with functions for each of the above operations
2	Design, Develop and Implement a menu driven Program in C Language for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX) a. Push an Element on to Stack b. Pop an Element from Stack c. Demonstrate Overflow and Underflow situations on Stack d. Display the status of Stack e. Exit Support the program with appropriate functions for each of the above operations
3	Design, Develop and Implement a Program in C Language for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, % (Remainder), ^ (Power) and alphanumeric operands.
4	Design, Develop and Implement a Program in C Language for Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^
5	Design, Develop and Implement a Program in C Language using Recursion for a. generating Fibonacci series of **n** numbers b. Solving Tower of Hanoi problem with n disks
6	Design, Develop and Implement a menu driven Program in C Language for the following operations on QUEUE of Integers (Array Implementation of Queue with maximum size MAX) a. Insert an Element on to QUEUE b. Delete an Element from QUEUE

	c. Demonstrate Overflow and Underflow situations on QUEUE d. Display the status of QUEUE e. Exit Support the program with appropriate functions for each of the above operations
7	Design, Develop and Implement a menu driven Program in C Language for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX) a. Insert an Element on to Circular QUEUE b. Delete an Element from Circular QUEUE c. Demonstrate Overflow and Underflow situations on Circular QUEUE d. Display the status of Circular QUEUE e. Exit Support the program with appropriate functions for each of the above operations
8	Design, Develop and Implement a menu driven Program in C Language for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Programme, Sem., Ph.No. a. Create a SLL of N Students Data by using front insertion. b. Display the status of SLL and count the number of nodes in it c. Perform Insertion / Deletion at End of SLL d. Perform Insertion / Deletion at Front of SLL (Demonstration of stack) e. Exit
9	Design, Develop and Implement a menu driven Program in C Language for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: SSN, Name, Dept., Designation, Sal, Ph.No. a. Create a DLL of N Employees Data by using end insertion. b. Display the status of DLL and count the number of nodes in it c. Perform Insertion and Deletion at End of DLL d. Perform Insertion and Deletion at Front of DLL e. Demonstrate how this DLL can be used as Double Ended Queue. f. Exit
10	Design, Develop and Implement a menu driven Program in C Language for the following operations on Binary Search Tree (BST) of Integers. a. Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2 b. Traverse the BST in Inorder, Preorder and Post Order c. Search the BST for a given element (KEY) and report the appropriate message d. Exit
11	Design, Develop and Implement a Program in C Language for the following operations on Graph (G) of Cities a. Create a Graph of N cities using Adjacency Matrix. b. Print all the nodes reachable from a given starting node in a digraph using DFS/BFS method
12	Create a Hash Table (HT) of **m** memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the keys in K and addresses in L are Integers. Design and develop a Program in C that uses Hash function H: K →L as H(K)=K mod m (remainder method), and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.

Course outcomes:

1. Design programs to implement basic operations on data structures.
2. Apply different data structures to solve problems.
3. Develop programs to demonstrate variants of queues and linked list
4. Implement various Searching techniques using trees and graphs.
5. Choose appropriate data structures to solve a given problem.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Reference Books				
1	Reema Thareja	Reema Thareja	Oxford press	Third edition and 2014
2	Fundamentals of Data Structures in C	Ellis Horowitz and Sartaj Sahni	Universities Press	Second Edition 2014
3	Data Structures: A Pseudo-code approach with C	Gilberg and Forouzan	Cengage Learning	Second Edition 2014
4	Data Structures using C	A M Tenenbaum	PHI	2001

Semester: III

Course Name: DIGITAL LAB

Course Code	21CSL36	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Credits	1	Exam Hours	03
Total Hours of Pedagogy	20	Total Marks	100

List of Experiments:

SN	Experiments
1	a) Realize 3-Variable and 4-variable Boolean expressions, simply it using K-map and Implement using basic gates. b) Simulate and verify the working of above expressions using VHDL
2	a) Design and implement Half adder and Full Adder using basic gates. b) Simulate and verify the working of Half adder and Full Adder using VHDL
3	a) Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer. b) Simulate and verify the working of 8:1 multiplexer using VHDL
4	a) Design and implement the Binary to Gray Code converter using basic gates. b) Simulate and verify the working of Binary to Gray Code converter using VHDL
5	Design and implement the Truth Table of 3-bit Parity Generator and 4-bit Parity Checker with an even parity bit using basic Gates.
6	a) Realize a J-K Master / Slave Flip-Flop using NAND gates and verify its truth table. b) Simulate and verify the working of D Flip-Flop with positive edge triggering using VHDL.
7	a) Design and implement a mod-n (n<8) synchronous up counter using J-K Flip-flop ICs b) Simulate and verify the working of mod-8 up counter using VHDL.
8	a) Design and implement an asynchronous counter using decade counter IC to count up from **0 to n** (n<=9) and demonstrate on 7-segment display (using IC7447). b) Simulate and verify the working of Switched tail counter using VHDL

Course outcomes:

1: Demonstrate the usage of various components of digital laboratory.
2: Use appropriate methods to design the given digital circuit.
3: Implement and test the designed circuit using digital ICs and instruments.
4: Examine and verify the design of digital circuits using simulators.
5: Construct an additional design based experiment.

BE - III / IV Semester – Common to All

ಬಳಕೆ ಕನ್ನಡ - baLake Kannada (Kannada for Usage)

ಕನ್ನಡ ಕಲಿಕೆಗಾಗಿ ನಿಗಡಿಪಡಿಸಿದ ಪಠ್ಯಪುಸ್ತಕ - (Prescribed Textbook to Learn Kannada)

ವಿಷಯ ಸಂಕೇತ (Course Code)	21KSK37/47	ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನದ ಅಂಕಗಳು (Continuous Internal Evaluation Marks)	100
ಒಂದು ವಾರಕ್ಕೆ ಬೋಧನಾ ಅವಧಿ (Teaching Hours / Week (L:T:P: S)	1–0–0		
ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ Total Hours of Pedagogy	15 ಗಂಟೆಗಳು	ಒಟ್ಟು ಅಂಕಗಳು (Total Marks)	100
ಕ್ರೆಡಿಟ್ಸ್ (Credits)	01	ಪರೀಕ್ಷೆಯ ಅವಧಿ (Exam Hours)	02 ಗಂಟೆ

ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು: (Course Learning Objectives):

- To create the awareness regarding the necessity of learning local language for comfortable and healthy life.
- To enable learners to Listen and understand the Kannada language properly.
- To speak, read and write Kannada language as per requirement.
- To train the learners for correct and polite conservation.

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ (Teaching-Learning Process - General Instructions) :

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. ಬಳಕೆ ಕನ್ನಡವನ್ನು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಬೋಧಿಸಲು ವಿಟಿಯು ಸೂಚಿಸಿರುವ ಪಠ್ಯಪುಸ್ತಕಗಳನ್ನು ಉಪಯೋಗಿಸಬೇಕು.
2. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಉತ್ತೇಜಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು.
3. ಪ್ರತಿ ವಿದ್ಯಾರ್ಥಿ ಪುಸ್ತಕವನ್ನು ತರಗತಿಯಲ್ಲಿ ಬಳಸುವಂತೆ ನೋಡಿಕೊಳ್ಳುವುದು ಮತ್ತು ಪ್ರತಿ ಪಾಠ ಮತ್ತು ಪ್ರವಚನಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧಪಟ್ಟಂತೆ ಪೂರಕ ಚಟುವಟಿಕೆಗಳಿಗೆ ತೊಡಗಿಸತಕ್ಕದ್ದು.

1. ಡಿಜಿಟಲ್ ತಂತ್ರಜ್ಞಾನದ ಮುಖಾಂತರ ಇತ್ತೀಚಿಗೆ ಡಿಜಿಟಲೀಕರಣಗೊಂಡಿರುವ ಭಾಷೆ ಕಲಿಕೆಯ ವಿಧಾನಗಳನ್ನು ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ಮುಖಾಂತರ ಚರ್ಚಿಸಲು ಕ್ರಮಕೈಗೊಳ್ಳುವುದು. ಇದರಿಂದ ವಿದ್ಯಾಥಿಗಳನ್ನು ತರಗತಿಯಲ್ಲಿ ಹೆಚ್ಚು ಏಕಾಗ್ರತೆಯಿಂದ ಪಾಠ ಕೇಳಲು ಮತ್ತು ಅಧ್ಯಯನದಲ್ಲಿ ತೊಡಗಲು ಅನುಕೂಲವಾಗುತ್ತದೆ.
2. ಭಾಷಾಕಲಿಕೆಯ ಪ್ರಯೋಗಾಲಯದ ಮುಖಾಂತರ ಬಹುಬೇಗ ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಕಲಿಯಲು ಅನುಕೂಲವಾಗುವಂತೆ ಕಾಯಚಟುವಟಿಕೆಗಳನ್ನು ಮತ್ತು ಕ್ರಿಯಾ ಯೋಜನೆಗಳನ್ನು ರೂಪಿಸುವುದು.

Module-1

1. Introduction, Necessity of learning a local language. Methods to learn the Kannada language.
2. Easy learning of a Kannada Language: A few tips. Hints for correct and polite conservation, Listening and Speaking Activities
3. Key to Transcription.
4. ವೈಯುಕ್ತಿಕ, ಸ್ವಾಮ್ಯಸೂಚಕ / ಸಂಬಂಧಿತ ಸಾರ್ವನಾಮಗಳು ಮತ್ತು ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು - Personal Pronouns, Possessive Forms, Interrogative words

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ:
ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

Module-2

1. ನಾಮಪದಗಳು ಸಂಬಂಧಾರ್ಥಕ ರೂಪಗಳು, ಸಂದೇಹಾಸ್ಪದ ಪ್ರಶ್ನೆಗಳು ಮತ್ತು ಸಂಬಂಧವಾಚಕ ನಾಮಪದಗಳು - Possessive forms of nouns, dubitative question and Relative nouns
2. ಗುಣ, ಪರಿಮಾಣ ಮತ್ತು ವರ್ಣಬಣ್ಣ ವಿಶೇಷಣಗಳು, ಸಂಖ್ಯಾವಾಚಕಗಳು Qualitative, Quantitative and Colour Adjectives, Numerals
3. ಕಾರಕ ರೂಪಗಳು ಮತ್ತು ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು – ಸಪ್ತಮಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯ – (ಆ, ಅದು, ಅವು, ಅಲ್ಲಿ) Predictive Forms, Locative Case

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ:
ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

Module-3

1. ಚತುರ್ಥಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯದ ಬಳಕೆ ಮತ್ತು ಸಂಖ್ಯಾವಾಚಕಗಳು - Dative Cases and Numerals
2. ಸಂಖ್ಯಾಗುಣವಾಚಕಗಳು ಮತ್ತು ಬಹುವಚನ ನಾಮರೂಪಗಳು - Ordinal Numerals and Plural markers.
3. ನ್ಯೂನ / ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾಪದಗಳು ಮತ್ತು ವರ್ಣ ಗುಣವಾಚಕಗಳು - Defective / Negative Verbs and Colour Adjectives.

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ:
ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

Module-4

1. ಅಪ್ಪಣೆ / ಒಪ್ಪಿಗೆ, ನಿರ್ದೇಶನ, ಪ್ರೋತ್ಸಾಹ ಮತ್ತು ಒತ್ತಾಯ ಅರ್ಥರೂಪ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು Permission, Commands, Encouraging and Urging words (Imperative words and sentences).
2. ಸಾಮಾನ್ಯ ಸಂಭಾಷಣೆಗಳಲ್ಲಿ ದ್ವಿತೀಯ ವಿಭಕ್ತಿ ಪ್ರತ್ಯೇಯಗಳು ಮತ್ತು ಸಂಭವನೀಯ ಪ್ರಕಾರಗಳು Accusative Cases and Potential Forms used in General Communication.
3. "ಇರು ಮತ್ತು ಇರಲ್ಲ" ಸಹಯಕ ಕ್ರಿಯಾಪದಗಳು, ಸಂಭಾವ್ಯಸೂಚಕ ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯ ಪದಗಳು. - Helping Verbs "iru and iralla", Corresponding Future and Negation Verbs.
4. ಹೋಲಿಕೆ (ತರತಮ), ಸಂಬಂಧ ಸೂಚಕ ಮತ್ತು ವಸ್ತು ಸೂಚಕ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಪದಗಳ ಬಳಕೆ. Comparative, Relationship, Identification and Negation Words

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ:
ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

Module-5

1. ಕಾಲ ಮತ್ತು ಸಮಯದ ಹಾಗೂ ಕ್ರಿಯಾಪದಗಳ ವಿವಿಧ ಪ್ರಕಾರಗಳು - different types of forms of Tense, Time and Verbs

2. ದ್, –ತ್, –ತು, –ಇತು, –ಆಗಿ, –ಅಲ್ಲ, –ಗ್, –ಕ್, ಇದೆ, ಕ್ರಿಯ ಪ್ರತ್ಯಯಗಳೊಂದಿಗೆ ಭೂತ, ಭವಿಷ್ಯತ್ ಮತ್ತು ವರ್ತಮಾನ ಕಾಲ ವಾಕ್ಯ ರಚನೆ Formation of Past, Future and Present Tense Sentences with Verb Forms
3. Kannada Vocabulary List : ಸಂಭಾಷಣೆಯಲ್ಲಿ ದಿನೋಪಯೋಗಿ ಕನ್ನಡ ಪದಗಳು - Kannada Words in Conversation

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ:

ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

ಬಳಕೆ ಕನ್ನಡ ಪತ್ಯದ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವ ಅನುಕೂಲಗಳು ಮತ್ತು ಫಲಿತಾಂಶಗಳು:

Skill Set: At the end of the Course, The Students will be able
1. To understand the necessity of learning of local language for comfortable life.
2. To Listen and understand the Kannada language properly.
3. To speak, read and write Kannada language as per requirement.
4. To communicate (converse) in Kannada language in their daily life with Kannada speakers.
5. To speak in polite conservation.

Textbook:

ಬಳಕೆ ಕನ್ನಡ
ಲೇಖಕರು: ಡಾ. ಎಲ್.ತಿಮ್ಮೇಶ
ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

BE – III / IV Semester – Common to all
ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ

ವಿಷಯ ಸಂಕೇತ (Course Code)	21KSK37/47	ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನದ ಅಂಕಗಳು	100
ಒಂದು ವಾರಕ್ಕೆ ಬೋಧನಾ ಅವಧಿ (Teaching Hours / Week (L:T:P:S)	1–0–0		
ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ Total Hours of Pedagogy	15 ಗಂಟೆಗಳು	ಒಟ್ಟು ಅಂಕಗಳು	100
ಕ್ರೆಡಿಟ್ಸ್ (Credits)	01	ಪರೀಕ್ಷೆಯ ಅವಧಿ	02 ಗಂಟೆ

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

1. ವೃತ್ತಿಪರ ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
2. ಕನ್ನಡ ಸಾಹಿತ್ಯಯದ ಪ್ರಧಾನ ಭಾಗವಾದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳನ್ನು ಸಾಂಕೇತಿಕವಾಗಿ ಪರಿಚಯಿಸಿ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಅರಿವು ಹಾಗೂ ಅವರುಗಳ ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
3. ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವನ್ನು ಹಾಗೂ ಅವರುಗಳು ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
4. ಕನ್ನಡ ಶಬ್ದ ಸಂಪತ್ತಿನ ಪರಿಚಯ ಮತ್ತು ಕನ್ನಡ ಭಾಷೆಯ ಬಳಕೆ ಹಾಗೂ ಕನ್ನಡದಲ್ಲಿ ಪತ್ರ ವ್ಯವಹಾರವನ್ನು ತಿಳಿಸಿಕೊಡುವುದು.

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ

(Teaching-Learning Process - General Instructions) :
These are sample Strategies, which teacher can use to accelerate the attainment of the course outcomes.

1. ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡವನ್ನು ಬೋಧಿಸಲು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಪ್ರಸ್ತುತ ಪುಸ್ತಕ ಆಧಾರಿಸಿ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನವನ್ನು ಅನುಸರಿಸುವುದು. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಪ್ರೇರೇಪಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು.

2. ಇತ್ತೀಚಿನ ತಂತ್ರಜ್ಞಾನದ ಅನುಕೂಲಗಳನ್ನು ಬಳಸಿಕೊಳ್ಳುವುದು – ಅಂದರೆ ಕವಿ–ಕಾವ್ಯ ಪರಿಚಯದಲ್ಲಿ ಕವಿಗಳ ಚಿತ್ರಣ ಮತ್ತು ಲೇಖನಗಳು ಮತ್ತು ಕಥೆ ಕಾವ್ಯಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧಪಟ್ಟ ಧ್ವನಿ ಚಿತ್ರಗಳು, ಸಂಭಾಷಣೆಗಳು, ಈಗಾಗಲೇ ಇತರ ವಿಮರ್ಶಕರು ಬರೆದಿರುವ ವಿಮರ್ಶಾತ್ಮಕ ವಿಷಯಗಳನ್ನು ಪಿಪಿಟಿ, ಡಿಜಿಟಲ್ ಮಾಧ್ಯಗಳ ಮುಖಾಂತರ ವಿಶ್ಲೇಷಿಸುವುದು.

3. ನವೀನ ಮಾದರಿಯ ಸಾಹಿತ್ಯ ಬೋಧನೆಗೆ ಸಂಬಂಧಪಟ್ಟ ವಿಧಾನಗಳನ್ನು ಶಿಕ್ಷಕರು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಅನುಕೂಲವಾಗುವ ರೀತಿಯಲ್ಲಿ ಅಳವಡಿಸಿಕೊಳ್ಳಬಹುದು.

ಘಟಕ–1 ಲೇಖನಗಳು

1. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ – ಹಂಪ ನಾಗರಾಜಯ್ಯ
2. ಕರ್ನಾಟಕದ ಏಕೀಕರಣ : ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ – ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ
3. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ – ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ ಮತ್ತು ಪ್ರೊ. ವಿ.ಕೇಶವಮೂರ್ತಿ

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ:

ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

ಘಟಕ–2 ಆಧುನಿಕ ಪೂರ್ವದ ಕಾವ್ಯ ಭಾಗ

1. ವಚನಗಳು : ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಆಯ್ದಕ್ಕಿ ಮಾರಯ್ಯ, ಜೇಡರದಾಸಿಮಯ್ಯ, ಆಯ್ದಕ್ಕಿ ಲಕ್ಕಮ್ಮ,
2. ಕೀರ್ತನೆಗಳು : ಅದರಿಂದೇನು ಫಲ ಇದರಿಂದೇನು ಫಲ – ಪುರಂದರದಾಸರು

ತಲ್ಲಣಿಸದಿರು ಕಂಡ್ಯ ತಾಳು ಮನವೇ – ಕನಕದಾಸರು

3. ತತ್ವಪದಗಳು : ಸಾವಿರ ಕೊಡಗಳ ಸುಟ್ಟು – ಶಿಶುನಾಳ ಶರೀಫ

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ:

ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

ಘಟಕ–3 ಆಧುನಿಕ ಕಾವ್ಯಭಾಗ

1. ಡಿವಿಜಿ ರವರ ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗದಿಂದ ಆಯ್ದ ಕೆಲವು ಭಾಗಗಳು
2. ಕುರುಡು ಕಾಂಚಾಣ : ದಾ.ರಾ. ಬೇಂದ್ರೆ
3. ಹೊಸಬಾಳಿನ ಗೀತೆ : ಕುವೆಂಪು

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ:

ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

ಘಟಕ–4 ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ

1. ಡಾ. ಸರ್.ಎಂ. ವಿಶ್ವೇಶ್ವರಯ್ಯ: ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ - ಎ ಎನ್ ಮೂರ್ತಿರಾವ್
2. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ – ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ:

ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

ಘಟಕ–5 ಕಥೆ ಮತ್ತು ಪ್ರವಾಸ ಕಥನ

1. ಯುಗಾದಿ: ವಸುಧೇಂದ್ರ
2. ಮೇಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ: ಹಿ.ಚಿ. ಬೋರಲಿಂಗಯ್ಯ

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ:

ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವು ಪರಿಣಾಮಗಳು: (Course Outcomes):

1. ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯವಾಗುತ್ತದೆ.
2. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಆಸಕ್ತಿಯು ಮೂಡುತ್ತದೆ.
3. ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ.
4. ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ, ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ.

ಪಠ್ಯಪುಸ್ತಕ:

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ

ಡಾ. ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯ ಮತ್ತು ಡಾ. ಎಲ್.ತಿಮ್ಮೇಶ

ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

Semester: III

Course Name: **CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND CYBER LAW**

Course Code	21CIP37/47	CIE Marks	50
Teaching Hours/Week (L:T:P)	1:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	1	Exam Hours	02

Module – 1

Introduction to Indian Constitution

The Making of the Constitution, The Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India. Fundamental Rights. Directive Principles of State Policy (DPSP). Fundamental Duties.

3 Hours

Module - 2

Union Executive and State Executive:

Parliamentary System, Federal System, Union Executive – President, Prime Minister, Union Cabinet, Parliament – Union Legislature, Lok Sabha and Rajya Sabha types of bills. Union judiciary Supreme Court of India.

3 Hours

Module – 3

Elections, Amendments and Emergency Provisions

Elections, Electoral Process, and Election Commission of India, Election Laws. Amendments - Methods in Constitutional Amendments. Important Constitutional Amendments. Amendments – 7,9,10,12,42,44, 61, 73,74, ,75, 86, and 91,94,95,100,101,118. Emergency Provisions, types of Emergencies and its consequences. Special Provisions (Articles 370.371,371J) for some States

3 Hours

Module – 4

Professional / Engineering Ethis:

Scope & Aims of Engineering & Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Role morality. What is profession characteristic of profession? The NSPE board of Professional ethics. Engineering ethics as preventive ethics. Responsible Engineer. Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. What is conflict of interest? Honesty integrity and reliability. IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering.

3 Hours

Module – 5

Internet Laws, Cyber Crimes and Cyber Laws:

Internet and Need for Cyber Laws, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000. Cybercrimes and enforcement agencies.

3 Hours

Course Outcomes:

1. Have constitutional knowledge and legal literacy.
2. Understand Engineering and Professional ethics and responsibilities of Engineers
3. Understand the cybercrimes and cyber laws for cyber safety measures

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Constitution of India, Professional Ethics and Human Rights	Shubham Singles, Charles E. Haries, and et al	Cengage Learning India	2018
2	Cyber Security and Cyber Laws	Alfred Basta and et al	Cengage Learning India	2018
3	Introduction to the Constitution of India	Durga Das Basu	Prentice –Hall	2008
4	Engineering Ethics	M. Govindarajan, S. Natarajan, V. S. Senthilkumar	Prentice –Hall	2004

Semester: III

Course Name: **UNIX AND SHELL PROGRAMMING**

Course Code	21ACS38	CIE Marks	50
Teaching Hours/Week (L: T :P)	1:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	1	Exam Hours	02

Pre-requisites: Knowledge of DOS and Windows

Module – 1

Introduction, Brief history, Unix Components /Architecture, Features of Unix, UNIX Environment, features of Unix commands, command structure, Command arguments, and options, Internal and external commands, Combining commands. Basic commands such as cal, date, echo, printf, passwd, who, wc, ls.

3 Hours

Module - 2

Unix files, Basic file types /categories, Parent-child relationship, the home directory and the HOME variable, PATH variable, manipulating the PATH, Relative and absolute pathnames.
Directory commands – pwd, cd, mkdir, rmdir commands, dot (.), and double dots (..) notations.
File related commands – cat, cp, rm, mv, wc.

3 Hours

Module – 3

The ls -l command, -d options, File ownership, File permissions, chmod, changing permission, Directory permissions, changing File ownership and group.
The vi editor, Different modes of vi, Input mode commands, Command mode commands, The ex-mode commands, Repeat command, Pattern searching, search and replace command.

3 Hours

Module – 4

The shells interpretive cycle, Wild cards, Escaping and Quoting, Three standard files and redirection, Connecting commands: Pipe, Splitting the output: tee, Command substitution. Ordinary and environment variables, Shell programming, read, Command line arguments, exit and exit status of a command, Logical operators for conditional execution, test command, and its shortcut, if, expr, while, for, and case-control statements, set and shift commands and handling positional parameters

3 Hours

Module – 5

Process basics, Mechanism of process creation, Parent and child process, The ps command with its options, Signals, Job control.
Hard link and soft link, umask, head, tail, cut, copy, paste, sort , and grep commands.

3 Hours

Course Outcomes:

1. Demonstrate the architecture and salient features of UNIX OS.

2. Understand UNIX Commands, Shell basic, and shell environments.
3. Create a file with vi editor and Apply changes in the file permission and ownership.
4. Design and develop shell programs using loops, and control statements.
5. Create UNIX Processes and a simple filter.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Unix Concepts and Applications	Sumitabha Das	Tata McGraw Hill	4th Edition

Semester: III

Course Name: **DESIGN THINKING & INNOVATION**

Course Code	21DTI39	CIE Marks	50
Teaching Hours/Week (L:T:P)	1:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	1	Exam Hours	02

Course Category: Foundation

Preamble: This course provides an introduction to the basic concepts and techniques of engineering and reverses engineering, the process of design, analytical thinking and ideas, basics and development of engineering drawing, application of engineering drawing with computer aide.

Course objectives:

1. To explain the concept of design thinking for product and service development
2. To explain the fundamental concept of innovation and design thinking
3. To discuss the methods of implementing design thinking in the real world.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain concepts
3. Encourage collaborative (Group Learning) Learning in the class
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develops thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in multiple representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module – 1

PROCESS OF DESIGN **Understanding Design thinking** Shared model in team-based design – Theory and practice in Design thinking – Explore presentation signers across globe – MVP or Prototyping **5-Hours**
Teaching-Learning Process:
1. Introduction about the design thinking: Chalk and Talk method 2.Theory and practice through presentation 3. MVP and Prototyping through live examples and videos

Module - 2

Tools for Design Thinking
Real-Time design interaction capture and analysis – Enabling efficient collaboration in digital space – Empathy for design – Collaboration in distributed Design

5-Hours

Teaching-Learning Process:

1. Case studies on design thinking for real-time interaction and analysis
2. Simulation exercises for collaborated enabled design thinking
3. Live examples on the success of collaborated design thinking.

Module – 3

Design Thinking in IT
Design Thinking to Business Process modelling – Agile in Virtual collaboration environment – Scenario based Prototyping

5-Hours

Teaching-Learning Process:

1. Case studies on design thinking and business acceptance of the design
2. Simulation on the role of virtual eco-system for collaborated prototyping
3. Chalk and Talk are used for Problem Solving.

Module – 4

DT For strategic innovations
Growth – Story telling representation – Strategic Foresight - Change – Sense Making - Maintenance Relevance – Value redefinition - Extreme Competition – experience design - Standardization – Humanization - Creative Culture – Rapid prototyping, Strategy and Organization – Business Model

5-Hours

Teaching-Learning Process:

1. Business model examples of successful designs.
2. Presentation by the students on the success of design.
3. Live project on design thinking in a group of 4 students.

Module – 5

Design thinking workshop
Design Thinking Workshop Empathize, Design, Ideate, Prototype and Test

5-Hours

Teaching-Learning Process:

Design thinking workshop from the expect and then presentation by the students on the learning from the workshop

Course Outcomes: At the end of the course the student will be able to**,**
C01:1.Identify the methods, processes, and tools of Design Thinking
C02: Apply the Design Thinking approach and model to real world situations
C03: Propose design ideas through different Technique
C04: Develop technical drawings for design ideas
C05: Execute innovation driven projects using design thinking principles

Assessment Details

CIE:

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools (AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem-based learning.

SEE:

SEE paper will be set for 100 questions of each of 01 marks. The pattern of the question paper is MCQ. The time allotted for SEE is 02 hours

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Engineering Design	John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson	Cengage learning	Second Edition, 2013
2	The Design of Business	Roger Martin	Harvard Business Press	2009
3	Design Thinking: Understand – Improve – Apply	Hasso Plattner, Christoph Meinel and Larry Leifer	Springer	2011.
Reference Books				
1	Design Thinking for Strategic Innovation	Idris Mootee	John Wiley & Sons	Second Edition, 2011
2	Engineering Design Process	Yousef Haik and Tamer M.Shahin	CengageLearning	1st edition, 2012

E-Resources:

1. www.tutor2u.net/business/presentations/. /**product lifecycle**/default.html
2. https://docs.oracle.com/cd/E11108_02/otn/pdf/. /E11087_01.pdf
3. www.bizfilings.com › Home › Marketing › Product Development
4. https://www.mindtools.com/brainstm.html
5. https://www.quicksprout.com/. /how-to-**reverse**-**engineer**-your-competitor
6. www.vertabelo.com/blog/documentation/**reversengineering**
7. https://support.microsoft.com/en-us/kb/273814
8. https://support.google.com/docs/answer/179740?hl=en

9. https://www.youtube.com/watch?v=2mjSDIBaUlMthevirtualinstructor.com/foreshortening.html
10. https://dschool.stanford.edu/.../designresources/.../ModeGuideBOOTCAMP2010L.pdf
11. https://dschool.stanford.edu/use-our-methods/
12. https://www.interaction-design.org/literature/article/stages-in-the-design-thinking-process
13. http://www.creativityatwork.com/design-thinking-strategy-for-innovation/ 49 8.
14. https://www.nngroup.com/articles/design-thinking/
15. https://designthinkingforeducators.com/design-thinking/
16. www.designthinkingformobility.org/wp-content/.../10/NapkinPitch_Worksheet.pdf

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

http://dschool.stanford.edu/dgift/

Semester: III

Course Name: **ADDITIONAL MATHEMATICS-I**

Course Code	21MATDIP31	CIE Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	-
Total Hours of Pedagogy	40	Total Marks	100
Credits	00	Exam Hours	-

Pre-requisites:

- Algebraic formulae
- Differentiation
- Integration
- Trigonometric formulae

Module – 1

Linear Algebra
Introduction-Rank of matrix by elementary row operations- Echelon form. Consistency of system of linear equations, Solution of linear equations-Gauss elimination method. Eigen values and Eigen vectors of a square matrix. Problems.
Self-Study: Gauss Jordon Method

8 Hours

Module - 2

Differential Calculus:
Review of successive differentiation-Illustrative examples. Maclaurin's series expansions-Illustrative examples. Partial Differentiation: Euler's theorem-problems on first order derivatives only. Total derivatives-differentiation of composite functions. Jacobian of order two-problems. **Self-Study: Taylor's series expansion.**

8 Hours

Module – 3

Vector Differentiation:
Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and Vector point functions. Gradient, Divergence and Curl- Simple problems. Solenoidal and irrotational vector fields-Problems.
Self-Study: Angle between two surfaces

8 Hours [RBT Levels: L1, L2,L3]

Module – 4

Integral Calculus:
Review of elementary integral calculus. Reduction formulae for $Sin^n x, Cos^n x$(with proof) and $Sin^m x\ Cos^n x$ (without proof) and evaluation of these with standard limits- Examples. Double and triple integrals-Simple problems.
Self-Study: Change of Order of Integration.

8 Hours

Module – 5

Ordinary Differential Equations:
Introduction-Solutions of first order and first degree differential equation: exact, Equation reducible to exact. Linear differential equations and Bernoulli's equation.
Self-Study: Homogeneous differential equations

8 Hours

Course outcomes: Upon Completion of this course, student will be able to,

1. Make use of matrix theory for solving system of linear equations and compute eigen values and Eigen vectors.
2. Learn the notion of partial differentiation to calculate the rate of change of multivariate functions and solve problems related to composite functions and Jacobians
3. Illustrate the applications of multivariate calculus to understand the solenoidal and irrotational vectors
4. Apply the concept of integration and variables to evaluate multiple integrals and their usage in computing the area and the volumes.
5. Solve first order linear differential equations analytically using standard methods.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Higher Engineering Mathematics	B.S.Grewal	Khanna Publishers	43rd Ed.2015
2	Advanced Engineering Mathematics	E. Kreyszig	John Willy & Sons	10th Ed. (Reprint). 2016
3	Additional Mathematics-1	Dr. Pandurangappa	Sanguine Technical Publishers	4Th Ed., 2019.
Reference Books				
1	Higher Engineering Mathematics	B.V. Ramana	Tata McGraw-Hill	11th Edition.2010

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
Semester IV

Course Name: **LINEAR ALGEBRA, PROBABILITY AND STATISTICAL METHODS**

Course Code	21MCE41	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	03

Pre-requisites:

- Basic formulae of differentiation and Integration
- Matrices and determinants
- Statistics and probability

Module – 1

Vector Spaces and Linear Equations: Vector spaces and subspaces, Linear Independence, Basis and Dimension. The four fundamental Subspaces, Linear Transformation, Rank Nullity Theorem.
Orthogonality: Orthogonal vector, Projections, Least Square approximations, orthonormal bases and Gram-Schmitt Orthogonalization.
Self-Study: Gaussian Elimination.

8 Hours

Module - 2

Determinants:
Eigen Values and Vectors: Introduction to Eigen values and vectors. Diagonalization of matrix, positive definite matrices (Tests for Positive definite matrices) Symmetric matrices (some important theorems) Singular Value decomposition (SVD)
Self-Study: transpose of a matrix

8 Hours

Module – 3

Statistical Methods: Correlation and regression- Karl Pearson's coefficient of correlation and rank correlation, problems. Regression analysis, lines of regression, problems.
Curve Fitting: Curve fitting by the method of least squares, fitting the curves of the forms $y = ax + b, y = ax^b \text{ and } y = ax^2 + bx + c$.
Self-Study: Angle between two regression lines, problems.

8 Hours

Module – 4

Probability Distributions: Review of basic probability theory. Random Variable (discrete and continuous), probability mass and density functions. Mathematical expectation, mean and variance. Binomial, Poisson and normal distributions-problems (derivations for mean and standard deviation for Binomial and Poisson distributions only)-Illustrative examples.
Self-Study: Exponential distribution.

8 Hours

Module – 5

Joint Probability Distribution: Joint Probability distribution for two discrete random variables, expectation, covariance and correlation.
Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, Student's t-distribution and Chi-square distribution as a test of goodness of fit.

Self-Study: Point estimation and interval estimation.

8 Hours

Course Outcomes: Upon completion of this course, student will be able to:

1. Understand the concept of Vector Spaces and its applications
2. Solve Differential equation and Discrete Dynamical system using the concept of Eigen value and Eigen Vector
3. Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
4. Applying discrete and continuous probability distributions in analysing the probability models arising in engineering field.
5. Construct joint probability distributions and demonstrate the validity of testing hypothesis.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Higher Engineering Mathematics	B.S.Grewal	Khanna Publishers	43rd Ed.2015
2	Advanced Engineering Mathematics	E. Kreyszig	John Willy & Sons	10th Ed. (Reprint).2016
3	Linear Algebra and its Applications	Gilbert Strang	Cengage Publishers	4th edition.2014
4	Linear Algebra and Application	David C Lay	Pearson Education	6th edition
Reference Books				
1	Higher Engineering Mathematics	B.V. Ramana	Tata McGraw-Hill	11th Edition.2010
2	Calculus	George. B. Thomas		
3	A Text book of Engineering Mathematics	N.P. Bali and Manish Goyal	Laxmi Publications	Latest edition
4	Linear Algebra	Kenneth Hoffmann, Ray Kunze	Prentice Hall India Learning Private Limited	2 nd Edition 1978

Semester: IV

Course Name: SOFTWARE ENGINEERING

Course Code	21CS42	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	50
Total Hours of Pedagogy	40 T + 20 P	Total Marks	100
Credits	4	Exam Hours	03

Pre-requisites: Students must have

- Programming Knowledge of C or Java

Module – 1

Introduction to Software Engineering: Need for Software Engineering, Software Engineering Ethics.
Software Process Models: Waterfall Model, Incremental Model, and Spiral Model. Rational Unified Process (RUP).
Requirements Engineering Process: Requirements Elicitation and Analysis.
Functional and Non-Functional Requirements. Software Requirements Document.
Requirements Specification. Requirements Validation.

8 Hours

Laboratory Component : Identify the Problem statement and gather the requirements

Module - 2

System Model: Context Models, Interaction Models, Structural Models, Behavioral Models.
Object-oriented design: OO Themes, **Three Models:** Class Modelling, Object and Class, Link and associations, Generalization and Inheritance, Object Oriented Design Process, Use Case, Sequence and State Diagrams.

8 Hours

Laboratory Component: Design Object Oriented System using UML diagrams

Module – 3

Software Testing and Maintenance: Development Testing, Test-Driven Development, Release Testing User Testing, Test Automation, Test Scripts
Evolution Process: Program Evolution Dynamics, Software Maintenance, Legacy System Management.

8 Hours

Laboratory Component: Design Test cases to test the program

Module – 4

Project Planning: Software Pricing, Project Scheduling, Estimation Techniques, Software
Standards, Software Quality, Reviews and Inspections, Software Measurement, and Metrics.

8 Hours

Laboratory Component: Develop an activity chart, a bar chart, and a staff allocation chart showing the critical path for the scheduled project

Module – 5

Agile methods: Agile Software Development: Coping with Change, The Agile Manifesto: Values and Principles. Agile methods: Extreme Programming. Plan-driven and agile development. Agile project management **8 Hours [RBT Levels: L1,L2,L3]**
Laboratory Component: Develop Software modules using extreme programming concepts

PRACTICAL COMPONENT OF IPCC

Sl. No.	Experiment
1	Super Market
2	Hospital Management
3	Whether Forecasting System
4	Library Management System
5	Hotel Management System
6	Ticket Booking System
7	Inventory Management System

Guidelines:

1. Identify the Problem.
2. Prepare the SRS.
3. Prepare the Design diagrams.
4. Implement the proposed system using any programming language
5. Design Test cases.
6. Prepare a report.

Course Outcomes:

1. Outline the Software Engineering principles and activities.
2. Construct appropriate process models and system models.
3. Apply OOC for the design of Software.
4. Apply appropriate Testing methods.
5. Design a software system, component, or process to meet desired needs within realistic constraints.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Software Engineering	Ian Somerville	Pearson Education	2012
Reference Books				
1	An Integrated Approach to Software Engineering	Pankaj Jalote	Wiley Publications	2010

Semester: IV

Course Name: **DESIGN AND ANALYSIS OF ALGORITHMS**

Course Code	21CS43	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	03

Pre-requisites: Should have a basic knowledge of mathematics, problem solving skills.

Module – 1

Introduction:
Fundamentals of Algorithmic Problem Solving, **Fundamentals of the Analysis of Algorithm Efficiency**: The Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non recursive Algorithm, Mathematical Analysis of Recursive Algorithms.

8 Hours

Module - 2

Brute Force and Exhaustive Search: Selection Sort and Bubble Sort, Exhaustive Search.
Decrease-and-Conquer: Insertion Sort, Topological Sorting, Algorithms for Generating Combinatorial Objects, Decrease by- a-Constant-Factor Algorithms: Binary Search, Variable-Size-Decrease Algorithms: Computing Median and the Selection Problem.

8 Hours

Module – 3

Divide-and-Conquer: Recurrence equation for divide and conquer, Master Theorem, Finding the maximum and minimum, Mergesort, Quicksort, Binary Search, Strassen's Matrix Multiplication.
Transform-and-Conquer: Presorting, Heaps and Heapsort, Problem Reduction Computing the Least Common Multiple. **8 Hours**

Module – 4

Greedy Method: General method, Knapsack Problem, Job sequencing with deadlines**,** Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm
Dynamic Programming: The Knapsack Problem, Warshall's and Floyd's Algorithms. Bellman-Ford Algorithm, Travelling Sales Person problem.

8 Hours

Module – 5

Backtracking: *n*-Queens Problem, Subset-Sum Problem, Graph coloring, Hamiltonian cycles.
Branch-and-Bound: Knapsack Problem, Traveling Salesman Problem, Assignment Problem, **NP-Complete and NP-Hard problems:** Basic concepts, non-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes.

8 Hours

Course Outcomes:

1. Apply the basic knowledge of mathematical fundamentals for finding time complexity of recursive and non-recursive algorithms.
2. Describe various algorithm design techniques to solve a given problem.
3. Apply various design techniques to find the time complexity of a given problem
4. Compare efficiency of different algorithm design techniques for a given problem
5. Choose the appropriate algorithm design techniques for a given problem.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Introduction to the Design and Analysis of Algorithms	Anany Levitin	Pearson	2nd Edition, 2009
2	Computer Algorithms/C++	Ellis Horowitz, Satraj Sahni and Rajasekaran	Universities Press	2nd Edition, 2014
Reference Books				
1	Introduction to Algorithms	Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein	PHI	3rd Edition, 2009
2	Design and Analysis of Algorithms	S. Sridhar	Oxford, Higher Education	2014

Semester: IV

Course Name: **MICROCONTROLLER AND EMBEDDED SYSTEMS**

Course Code	21CS44	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Pre-requisites:

1. Computer Organization
2. Digital electronics
3. C programming
4. Basics of operating system

Module – 1

Microprocessors versus Microcontrollers, ARM Embedded Systems: The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software.

ARM Processor Fundamentals: Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table, Core Extensions

8 Hours

Module - 2

Introduction to the ARM Instruction Set: Data Processing Instructions, Branch Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants,

ARM programming using Assembly language: Writing Assembly code, Conditional Execution, Looping Constructs

8 Hours

Module – 3

Embedded System Components: Embedded Vs General computing system, History of embedded systems, Classification of Embedded systems, Major applications areas of embedded systems, purpose of embedded systems. Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, stepper motor, Keyboard, Push button switch, Communication Interface (onboard and external types), Embedded firmware, Other system components.

8 Hours

Module – 4

Embedded System Design Concepts: Characteristics and Quality Attributes of Embedded Systems, Embedded Systems-Application and Domain specific, Hardware Software Co-Design and Program Modeling

8 Hours

Module – 5

RTOS and IDE for Embedded System Design: Operating System basics, Types of operating systems, Task, process and threads (Only definitions of thread standards), Thread preemption, Multiprocessing and Multitasking, , Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excluding Keil), Disassembler /decompiler, simulator, emulator and debugging techniques, target hardware debugging.

8 Hours

Course Outcomes:

1. Summarize the fundamentals of ARM based systems.
2. Develop ARM based assembly language programs.
3. Interpret the components of embedded systems.
4. Demonstrate effectively Embedded System design concepts with examples.
5. Realize the real time operating system concepts used in the embedded system.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	ARM system developers guide	Andrew N Sloss, Dominic Symes and Chris Wright	Elsevier, Morgan Kaufman	2008.
2	Introduction to Embedded Systems	Shibu K V	Tata McGraw Hill Education, Private Limited.	2nd Edition
Reference Books				
1	Computers as Components: Principles of Embedded Computing System Design	Marilyn wolf	Elsevier-Morgan Kaufmann	Third edition/2012

Semester: IV

Course Name: **DESIGN AND ANALYSIS OF ALGORITHMS LAB**

Course Code	21CSL45	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total Hours of Pedagogy	20	Total Marks	100
Credits	01	Exam Hours	03

List of Experiments:

Identify the functional requirements, then Design and Develop solutions to the following list of problems

SN	Experiments
1	a. Create a Java class called Student with the following details as variables within it. (i) USN (ii) Name (iii) Programme (iv) Phone Write a Java program to create n Student objects and print the USN, Name, Programme, and Phone of these objects with suitable headings. b. Write a Java program to implement the Stack using arrays. Write Push(), Pop(), and Display() methods to demonstrate its working.
2	a. Design a superclass called Staff with details as StaffId, Name, Phone, Salary. Extend this class by writing three subclasses namely Teaching (domain, publications), Technical (skills), and Contract (period). Write a Java program to read and display at least 3 staff objects of all three categories. b. Write a Java class called Customer to store their name and date_of_birth. The date_of_birth format should be dd/mm/yyyy. Write methods to read customer data as <name, dd/mm/yyyy> and display as <name, dd, mm, yyyy> using StringTokenizer class considering the delimiter character as “/”.
3	Write a Java program to read two integers a and b. Compute a/b and print, when b is not zero. Raise an exception when b is equal to zero.
4	Sort a given set of N integer elements using Select ion Sort technique and compute its time taken. Run the program for different values of N and record the time taken to sort.
5	Sort a given set of N integer elements using Insert ion Sort technique and compute its time taken.
6	Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n> 5000 and record the time taken to sort. Plot a graph of the time taken versus non graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case. **Compare the priori and posteriori analysis of an algorithm.**
7	Sort a given set of N integer elements using Merge Sort technique and compute its time taken. Run the program for different values of N and record the time taken to sort. **Compare the priori and posteriori analysis of an algorithm**

8	Find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm
9	Find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskals algorithm
10	From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm. Write the program in Java.
11	Implement All-Pairs Shortest Paths problem using Floyd's algorithm and find transitive closure of a given graph using Warshalls Algorithm
12	Implement in Java, the 0/1 Knapsack problem using Dynamic Programming method
13	Design and implement in Java to find a subset of a given set S = {Sl, S2,.....,Sn} of n positive integers whose SUM is equal to a given positive integer d. For example, if S ={1, 2, 5, 6, 8} and d= 9, there are two solutions {1,2,6}and {1,8}. Display a suitable message, if the given problem.
14	Implement “ N-Queens problem” using Backtracking.
15	Implement Topological Sorting using DFS based method

Course outcomes:

1. Design programs to implement basic concepts of java programs.
2. Apply various algorithm design techniques to solve sorting problems.
3. Implement graph Applications using various design techniques.
4. Execute programs on combinatorial problems using Backtracking technique.
5. Choose appropriate design technique to solve a given problem.

Suggested Learning Resources:

Reference Books:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Introduction to the Design and Analysis of Algorithms	Anany Levitin	Pearson	2nd Edition,2009
2	Computer Algorithms/C++	Ellis Horowitz, SatrajSahni and Rajasekaran	Universities press	2nd Edition, 2014
3	Introduction to Algorithms	Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein	PHI	3rd Edition
4	Design and Analysis of Algorithms	S. Sridhar	Oxford (Higher Education)	

Semester: IV

Course Name: **MICROCONTROLLER AND EMBEDDED SYSTEMS LAB**

Course Code	21CSL46	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total hours of Pedagogy	20	Total Marks	100
Credits	1	Exam Hours	03

List of Experiments:

PART A

Conduct the following experiments by writing program using **ARM7TDMI/LPC2148** using an evaluation board/simulator and the required software tool.

SN	Experiments
1	a. Write a program to add, subtract and multiply two 16-bit binary numbers. b. Write a program to add and subtract two 64-bit binary numbers.
2	Write a program to find the sum of first 10 integer numbers.
3	Write a program to find Fibonacci series up to a given number
4	Write a program to add an array of 16-bit numbers and store the 32-bit result in internal RAM
5	Write a program to find the square of a number (1 to 10) using look-up table.
6	Write a program to find the largest/smallest number in an array of 32-bit numbers.
7	Write a program to count the number of ones and zeros in two consecutive memory locations.

PART B

Conduct the following experiments on an ARM7TDMI/LPC2148 evaluation board using evaluation version of Embedded 'C' & Keil U vision-4 tool/compiler.

SN	Experiments
8	Display “Welcome to BITM” message using Internal UART.
9	Interface and Control a DC Motor.
10	Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.
11	Interface a DAC and generate Triangular and Square waveforms.
12	Interface and control a Buzzer ON and OFF.
13	Demonstrate the use of an external interrupt to toggle an LED On/Off.
14	Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between.

Course outcomes:

1. Demonstrate the usage of KEIL-4 IDE and ARM7TDMI/LPC2148 kit.
2. Apply ARM instruction set and addressing modes.
3. Develop and test assembly language program using ARM7TDMI/LPC2148.
4. Develop and test embedded C firmware on ARM7 target hardware board.
5. Construct an additional design based experiment.

Reference Books:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	ARM system developer’s guide	Andrew N Sloss, Dominic Symes and Chris Wright	Morgan Kaufman publishers	2008
2	Introduction to Embedded Systems	Shibu K V	Tata McGraw Hill Education	2nd Edition

Semester: IV

Course Name: SOFT SKILLS AND BASIC APTITUDE

Course Code	21SSA480	CIE Marks	50
Teaching Hours/Week (L:T:P)	1:2:0	SEE Marks	50
Total Hours of Pedagogy	30	Total Marks	100
Credits	2	Exam Hours	02

Pre-requisites:

- Basic Conversational English
- Fundamentals of Mathematics
- Basic Knowledge of Reasoning

Module – 1

Communication Skills

Basic Tools of Communication, Listening Skills, Body Language, Voice, Verbal Language, Conversations in Professional Setting

6 Hours

Module – 2

Presentation Skills

Zero Presentation, Individual Presentations, Feedback, Types of Introductions, Captivating the Audience, Interaction Methods, Signing off.

6 Hours

Module – 3

Verbal & Numerical Ability

Vocabulary is Fun, Root Words, Sentence Structures, Bouncing, Similar and Opposite Words, Common Errors, Number System, Factors and Multiples.

6 Hours

Module – 4

English Language

Phonetic and Non-phonetic Languages, sounds in English, IPA, Syllables, Word Stress, Stress patterns in Indian languages vs English, Pausing and Rhythm in English, Sentence Structures, Bouncing, Common Errors

6 Hours

Module – 5

Verbal Ability and Verbal Reasoning

Similar and Opposite words, Number and Alphabet Series, Human Relations, Direction Tests, Coding Decoding, Clocks and Calendars

6 Hours

Course Outcomes:

1. Demonstrate communicative ability in a professional environment
2. Articulate one's ideas and demonstrate them to an audience
3. Transform one's English Vocabulary and Language Structure
4. Interpret international phonetic symbols, stress patterns, and enhance English speech
5. Identify patterns, determine the problem-solving process & validate solutions

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Reasoning N' Reasoning - Verbal & Non-verbal Reasoning	Dr. Ravi Chopra	Galgotia	1994
2	Magical Book on Quicker Math	M. Tyra	BSC	I Edition, 2018
3	Communicate With Confidence	Diana Booher	Mc-Graw-Hill	Nov 2011
Reference Books				
1	Cambridge Advanced Learner's Dictionary	Cambridge University Press	CBS	IV Edition, 2013
2	A Modern Approach to Verbal and Non-verbal Reasoning	R S Agarwal	S Chand	II Edition, 2018
3	Word Power Made Easy	Norman Lewis	Goyal Publishers	IV Edition, 2014
4	Speak With Confidence	Diana Booher	Mc-Graw-Hill	I Edition, 2002

Semester: IV

Course Name: **BIOLOGY FOR ENGINEERS**

Course Code	21ABE481	CIE Marks	50
Teaching Hours/Week (L:T:P)	1:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	1	Exam Hours	2

Module – 1

BIOMOLECULES AND THEIR APPLICATIONS (QUALITATIVE):
Carbohydrates (cellulose-based water filters, PHA and PLA as bioplastics), Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics – DNA fingerprinting), Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins), lipids (biodiesel, cleaning agents/detergents), Enzymes (glucose-oxidase in biosensors, lignolytic enzyme in bio-bleaching).

3 Hours

Module - 2

HUMAN ORGAN SYSTEMS AND BIO DESIGNS - 1 (QUALITATIVE):
Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease).Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye).Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators).

3 Hours

Module – 3

HUMAN ORGAN SYSTEMS AND BIO-DESIGNS - 2 (QUALITATIVE):
Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine).Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems). Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis).

3 Hours

Module – 4

NATURE-BIOINSPIRED MATERIALS AND MECHANISMS (QUALITATIVE):
Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train). Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and per flour carbons (PFCs).

3 Hours

Module – 5

TRENDS IN BIOENGINEERING (QUALITATIVE):
Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Self- healing Bioconcrete (based on bacillus spores, calcium lactate nutrients and biomineralization processes) and

Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic).

3 Hours

Course Outcomes:

1. Elucidate the basic biological concepts via relevant industrial applications and case studies.
2. Evaluate the principles of design and development, for exploring novel bioengineering projects.
3. Corroborate the concepts of biomimetic for specific requirements.
4. Think critically towards exploring innovative biobased solutions for socially relevant problems.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Human Physiology	Stuart Fox, Krista Rompolski	McGraw-Hill eBook	16th Edition, 2022
2	Biology for Engineers	Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K	Tata McGraw-Hill	2012
3	Biology for Engineers	Arthur T. Johnson	CRC Press, Taylor and Francis	2011
4	Biomedical Instrumentation	Leslie Cromwell	Prentice Hall	2011
5	Biology for Engineers	Sohini Singh and Tanu Allen	Vayu Education of India	2014
6	Biomimetics: Nature-Based Innovation	Yoseph Bar-Cohen	CRC Press	1st edition, 2012
7	Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies	D. Floreano and C. Mattiussi	MIT Press	2008
8	Bioremediation of heavy metals: bacterial participation	C R Sunilkumar, N Geetha A C Udayashankar Lambert	Academic Publishing	2019
9	3D Bioprinting: Fundamentals, Principles and Applications	Ibrahim Ozbolat	Academic Press	2016
10	Blood Substitutes	Robert Winslow	Elsevier	2005

Semester: IV

Course Name: R Programming

Course Code	21ACS482	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	1:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	1	Exam Hours	2

Pre-requisites:
Knowledge of basic computer hardware, Software and any programming language

Module – 1

Numeric, Arithmetic, Assignment, and Vectors: R for Basic Math, Arithmetic, Variables, Functions, Vectors, Expressions and assignments Logical expressions.

3 Hours

Teaching-Learning Process: Practical based learning

Module - 2

Matrices: Defining a Matrix, Sub-setting, Matrix Operations, **Conditions and Looping**: if statements, looping with for, looping with while, vector based programming.

3 Hours

Teaching-Learning Process: Practical based learning ,Demonstration

Module – 3

Lists and Data Frames: Data Frames, Lists: Special values, The apply family.

3 Hours

Teaching-Learning Process: Practical based learning

Module – 4

Programming with Functions -1: Functions, scope and its consequences, Arguments.

3 Hours

Teaching-Learning Process: Practical based learning

Module – 5

Programming with Functions -2: Vector Based programming using functions, Recursive Programming, Debugging functions.

3 Hours

Teaching-Learning Process: Practical based learning

Course Outcomes:
1. Apply the fundamentals of R Programming to solve basic mathematical functions.
2. Design and Develop R programs using branching and iterative statements.
3. Apply critical programming concepts to solve real life problems.
4. Demonstrate R programs using functions.
5. Develop simple applications using Vector Based Programming.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Introduction to Scientific Programming and Simulation Using R. Chapman & Hall/CRC	Jones, O., Maillardet. R. and Robinson.A	The R Series.	2014
Reference Books				
1	Statistics: An Introduction using R	Michael J. Crawley	Wiley	Second edition, 2015

Semester: IV

Course Name: **WEB DESIGNING**

Course Code	21ACS483	CIE Marks	50
Teaching Hours/Week (L:T:P)	1:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	1	Exam Hours	2

Pre-requisites:
Basic Concepts of Java Programming

Module – 1

Introduction to WEB Programming: Internet, WWW, Web Browsers, and Web Servers, URLs, MIME, HTTP, Security, The Web Programmers Toolbox.

3 Hours

Module - 2

HTML and XHTML: Origins of HTML and XHTML, Basic syntax, Standard XHTML document structure, Basic text markup, Images.

3 Hours

Module – 3

Elements of HTML and XHTML: Hypertext Links, Lists, Tables. Forms, Frames in HTML and XHTML, Syntactic differences between HTML and XHTML.

3 Hours

Module – 4

Java Script – I: Object orientation and JavaScript; General syntactic characteristics; Primitives, Operations, and expressions; Screen output and keyboard input.

3 Hours

Module – 5

Java Script – II: Control statements, Object creation and Modification; Arrays; Functions; Constructor; Pattern matching using expressions; Errors, Element access in JavaScript.

3 Hours

Course Outcomes:
1: Understand the principles of Web Programming.
2: Describe the fundamentals and concept of HTML & XHTML.
3: Use the concepts of HTML, XHTML to construct the web pages.
4: Evaluate different concepts of JavaScript & Construct dynamic documents.
5: Design a small project with JavaScript and XHTML.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Programming the World Wide Web	Robert W Sebesta	Pearson	6th Edition/ 2008
Reference Books				

1	Internet & World Wide Web How to program	M.Deitel, P.J.Deitel, A.B.Goldberg	PHI/ Pearson	3rd Edition/ 2004
2	Web Programming Building Internet Applications	Chris Bates	Wileys	3rd Edition/2006
3	The Web Warrior Guide to Web Programming	Xue Bai et al	Thomson	2003
4	The Web Warrior Guide to Web Design Technologies	Sklar	Cengage Learning India	1st Edition

Semester: IV

Course Name: **Universal Human Values: Understanding Harmony and Ethical Human Conduct**

Course Code	21UHV490	CIE Marks	50
Teaching Hours/Week (L:T:P)	1:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	1	Exam Hours	2

Module – 1

Introduction to Value Education
Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Understanding Value Education, Self-exploration as the Process for Value Education, Continuous
Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations

3 Hours

Module - 2

Harmony in the Human Being
Understanding Human being as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health

3 Hours

Module – 3

Harmony in the Family and Society
Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order

3 Hours

Module – 4

Harmony in the Nature/Existence
Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence

3 Hours

Module – 5

Implications of the Holistic Understanding – a Look at Professional Ethics
Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

3 Hours

Course Outcomes:
CO.1 Develop personality with responsibilities and self-respect.
CO.2 Build real world skills like communication, lifelong-learning and problem-solving.
CO.3 Create harmonious relationship among faculty and students.
CO.4 Provide an organized philanthropic service to the society through activities.
CO.5 Create awareness on health, yoga, human relationships, universal peace, environment, society and nation.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	A Foundation Course in Human Values and Professional Ethics, R	R Gaur, R Asthana, G P Bagaria,	Excel Books, New Delhi,	2nd Revised Edition, 2019. ISBN 978-93-87034-47-1
2	The Teachers Manual For A Foundation Course in Human Values and Professional Ethics, R	R Gaur, R Asthana, G P Bagaria,		
Reference Books				

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)
14. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
15. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome’s report, Universe Books.
16. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
17. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
18. A N Tripathy, 2003, Human Values, New Age International Publishers.
19. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
20. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press
21. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
22. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
23. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Semester: IV

Course Name: **ADDITIONAL MATHEMATICS-II**

Course Code	21MATDIP41	CIE Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	-
Total Hours of Pedagogy	40	Total Marks	100
Credits	0	Exam Hours	-

Pre-requisites:

- Differentiation
- Integration
- Trigonometric formulae
- Differential equations

Module – 1

Higher Order ODE's

Linear Differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators.[Particular integral restricted to $\phi(x) = e^{ax}, Sinax, Cosax$ for $f(D)y = \phi(x)$

Self-Study: Finding particular Integral for $\phi(x) = x^m$

8 Hours

Module - 2

Partial Differential Equations (PDE's):

Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct by integration. Homogeneous PDE involving derivative with respect to one independent variable only.

Self-Study: Method of separation of variables

8 Hours

Module – 3

Laplace Transform:

Definition, Laplace transforms of elementary functions. Laplace transform of $e^{at}f(t), t^n f(t)$ (without proof). Laplace transform of Periodic functions (statement only) and Unit-step function- problems.

Inverse Laplace Transform: Definition**,** Inverse Laplace Transform of standard functions. Inverse transform by Partial Fraction Method. Apply the concepts of Laplace Transforms to find the solution of linear differential equations.

Self-Study: Convolution Theorem

8 Hours

Module – 4

Numerical Methods:

Solution of algebraic and transcendental equations by Newton-Raphson method and Secant method.

Interpolation: Newton's Forward and Backward Interpolation formulae, Newton's divided difference formula, Lagrange's Interpolation formula-problems.

Numerical Integration: Simpson's 1/3rd and 3/8th rule (without proof) - problems.

Self-Study: Weddle's Rule

8 Hours

Module – 5

Probability:
Introduction, sample space and events. Axioms of probability. Addition & multiplication theorems. Conditional probability, Bayes' theorem. Problems.
Self-Study: Applications Bayes' theorem

8 Hours

Course outcomes: Upon completion of this course, student will be able to,

1. Demonstrate various physical models through higher order differential equations and solve such linear ordinary differential equations.
2. Construct a variety of partial differential equations and solution by various methods.
3. Use Laplace Transform and inverse Laplace Transform in solving differential /integral equation arising in network analysis, control systems and other fields of engineering
4. Apply the knowledge of numerical methods in the modeling of various physical and engineering phenomena.
5. Use the concepts of probability in different probability distribution.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Higher Engineering Mathematics	B.S.Grewal	Khanna Publishers	43rd Ed.2015
2	Advanced Engineering Mathematics	E. Kreyszig	Jhon willy & Sons	10th Ed. (Reprint).2016
3	Additional Mathematics-2	Dr. Pandurangappa	Sanguine Technical Publishers	4Th Ed., 2019.
Reference Books				
1	Higher Engineering Mathematics	B.V.Ramana	Tata McGraw-Hill	11th Edition.2010

SUGGESTED TEACHING LEARNING PROCESS

The faculty members are suggested to use appropriately the following Teaching Learning methods:

1. Active Learning
2. Chalk and Board for Numerical
3. Demonstration using simulator
4. Laboratory Demonstrations
5. Power Point Presentations
6. Problem based learning
7. Video Lecturers

Assessment Details

1. Integrated professional Core Courses (IPCC):

CIE for the Theory component of IPCC: 30 Marks

	Components	Number	Weightage	Max. Marks
1	Tests (A)	3	60%	18
2	Alternate Assessment Tools(AAT) (B)	3	40%	12
X	**Total Marks for theory component A+B**			**30**

CIE for the LAB component of IPCC: 20 Marks

	Components	Weightage	Max. Marks
1	Lab Work: Conduction of Experiments (A)	40%	08
2	Lab Journal Writing & Submission (B)	10%	02
3	Lab Test (C)	30%	06
4	Open-Ended Experiments / Course Projects (D)	20%	04
Y	**Total Marks**		**20**

Final Marks for IPCC Courses = X + Y = 30 + 20 = 50

SEE for IPCC Theory for 3 hours duration

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)
- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

2. Professional Core / Basic Science Courses (PCC / BSC) Theory:

Continuous Internal Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (**A**)	3	60%	30
(ii)	Alternate Assessment Tools(AAT) (**B**)	3	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B) = 30 + 20 = 50

Semester End Examination (SEE)

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE.
- Marks secured will be scaled down to 50.

3. Professional Core Course (PCC) Lab:

Continuous Internal Evaluation (CIE):

	Components	**Weightage**	**Max. Marks**
(i)	Lab Work: Conduction of Experiments (A)	40%	20
(ii)	Lab Journal Writing & Submission (B)	10%	05
(iii)	Lab Test (C)	30%	15
(iv)	Open-Ended Experiments (D)	20%	10
	Total Marks: A+B+C+D		**50**

Semester End Evaluation (SEE):

1. All laboratory experiments are to be included for practical examination
2. Students can pick one experiment from the lot with equal choice to all the students in a batch.
3. Change of experiment is allowed only once and 15% marks allotted to the procedure part to be made zero.
4. **Marks distribution**: **Procedure** (15%) + **Execution** (70%) + Viva Voce (15%)

Semester End Evaluation (SEE) for MC lab

1. All laboratory experiments (Part A and Part B) are to be included for practical examination
2. Students can pick one experiment from the questions lot of Part A with equal choice to all the students in a batch.
3. Weightage of marks for Part A is 50% and Part B is 50%
4. Change of experiment is allowed only once for Part A and Part B. 15% marks allotted to the procedure part to be made zero.
5. Marks distribution: Write-up (20%) + Conduction, Execution & Results (60%) + Viva voce (20%)

4. Ability Enhancement Course (AEC):

Assessment Details of CIE

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3	60%	30
(ii)	Alternate Assessment Tools (AAT) (B)	3	40%	20

	Total Marks			50

Final CIE Marks = (A) + (B)

SEE Guidelines for the Courses

- **a.** 21ACS38 - Unix and Shell Programming
- **b.** 21ACS482 **- R** Programming
- **c.** 21ACS483 - Web Designing

1. The pattern of the question paper consists of 5 Modules.
2. Each Module contains two questions where student needs to answer ONE full question from each module.
3. The time allotted for SEE is 02 hours

SEE Guidelines for the Courses

- a. 21CIP37/47 – Constitution of India, professional Ethics and Cyber Law
- b. 21DTI39 – Design Thinking and Innovation
- c. 21SSA480 – Soft Skills and Basic Aptitude
- d. 21ABE481 – Biology for Engineers
- **e.** 21UHV490 – Universal Human Values
    1. SEE will be conducted with common question papers for the subject.
    2. SEE Pattern will be in MCQ Model (Multiple Choice Questions) for 100 marks which will be scaled down to 50 marks.
    3. Duration of the examination is 02Hours

5. For the Courses

- a. 21MATDIP31 / 41 – Additional mathematics I and II
- b. 21KSK37/47 – Samskrutika Kannada
- c. 21KBK37/47 - Balake Kannada

Continuous Internal Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (**A**)	3	60%	60
(ii)	Alternate Assessment Tools(AAT) (**B**)	3	40%	40
	Total Marks			**100**

There is no SEE for the above Courses

Suggested Alternate Assessment Tools for PCC, IPCC and AEC Courses:

1. Quiz
2. Assignments
3. Seminars / Presentations
4. Paper Publications
5. Mini Projects
6. MOOCs
7. Industrial Visits and Report Writing
8. Self-learning with Certifications and
9. Cooperative and problem based learning.

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VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
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(Effective from the academic year 2018 – 19)

V SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	HSMC	18CS51	Management, Entrepreneurship for IT idustry	HSMC	2	2	--	03	40	60	100	3
2	PCC	18CS52	Computer Networks and Security	CS / IS	3	2	--	03	40	60	100	4
3	PCC	18CS53	Database Management System	CS / IS	3	2	--	03	40	60	100	4
4	PCC	18CS54	Automata theory and Computability	CS / IS	3	--	--	03	40	60	100	3
5	PCC	18CS55	Application Development using Python	CS / IS	3	--	--	03	40	60	100	3
6	PCC	18CS56	Unix Programming	CS / IS	3	--	--	03	40	60	100	3
7	PCC	18CSL57	Computer Network Laboratory	CS / IS	--	2	2	03	40	60	100	2
8	PCC	18CSL58	DBMS Laboratory with mini project	CS / IS	--	2	2	03	40	60	100	2
9	HSMC	18CIV59	Environmental Studies	Civil/ Environmental [Paper setting: Civil Engineering Board]	1	--	--	02	40	60	100	1
				TOTAL	**18**	**10**	**04**	**26**	**360**	**540**	**900**	**25**

Note: PCC: Professional Core, HSMC: Humanity and Social Science.

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

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VI SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	18CS61	System Software and Compilers	CS / IS	3	2	--	03	40	60	100	4
2	PCC	18CS62	Computer Graphics and Visualization	CS / IS	3	2	--	03	40	60	100	4
3	PCC	18CS63	Web Technology and its applications	CS / IS	3	2	--	03	40	60	100	4
4	PEC	18CS64X	Professional Elective -1	CS / IS	3	--	--	03	40	60	100	3
5	OEC	18CS65X	Open Elective –A	CS / IS	3	--	--	03	40	60	100	3
6	PCC	18CSL66	System Software Laboratory	CS / IS	--	2	2	03	40	60	100	2
7	PCC	18CSL67	Computer Graphics Laboratory with mini project	CS / IS	--	2	2	03	40	60	100	2
8	MP	18CSMP68	Mobile Application Development	CS / IS	--	--	2	03	40	60	100	2
9	INT	--	Internship	(To be carried out during the intervening vacations of VI and VII semesters)				--	--	--	--	--
				TOTAL	**15**	**10**	**06**	**24**	**320**	**480**	**800**	**24**

Note: PCC: Professional core, PEC: Professional Elective, OE: Open Elective, MP: Mini-project, INT: Internship.

Professional Elective -1	
Course code under18XX64X	**Course Title**
18CS641	Data Mining and Data Warehousing
18CS642	Object Oriented Modelling and Design
18CS643	Cloud Computing and its Applications
18CS644	Advanced JAVA and J2EE
18CS645	System Modelling and Simulation
Open Elective –A (Not for CSE / ISE Programs)	
18CS651	Mobile Application Development
18CS652	Introduction to Data Structures and Algorithms
18CS653	Programming in JAVA
18CS654	Introduction to Operating System

Students can select any one of the open electives offered by any Department (Please refer to the list of open electives under 18CS65X).
Selection of an open elective is not allowed provided,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Adviser/Mentor.

Mini-project work: Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the Mini-project work, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all the guides of the college. The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

SEE for Mini-project:

(i) Single discipline: Contribution to the Mini-project and the performance of each group member shall be assessed individually in the semester end examination (SEE) conducted at the department.

(ii) Interdisciplinary: Contribution to the Mini-project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belongs to.

Internship: All the students admitted to III year of BE/B.Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not takeup/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

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VII SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	PCC	18CS71	Artificial Intelligence and Machine Learning	CS / IS	4	--	--	03	40	60	100	4
2	PCC	18CS72	Big Data Analytics	CS / IS	4	--	--	03	40	60	100	4
3	PEC	18CS73X	Professional Elective – 2	CS / IS	3	--	--	03	40	60	100	3
4	PEC	18CS74X	Professional Elective – 3	CS / IS	3	--	--	03	40	60	100	3
5	OEC	18CS75X	Open Elective –B	CS / IS	3	--	--	03	40	60	100	3
6	PCC	18CSL76	Artificial Intelligence and Machine Learning Laboratory	CS / IS	--	--	2	03	40	60	100	2
7	Project	18CSP77	Project Work Phase – 1	CS / IS	--	--	2	--	100	--	100	1
8	INT	--	Internship	(If not completed during the vacation of VI and VII semesters, it has to be carried out during the intervening vacations of VII and VIII semesters								
				TOTAL	**17**	--	**04**	**18**	**340**	**360**	**700**	**20**

Note: PCC: Professional core, PEC: Professional Elective, OEC: Open Elective, INT: Internship.

Professional Elective - 2

Course code under 18CS73X	**Course Title**
18CS731	Software Architecture and Design Patterns
18CS732	High Performance Computing
18CS733	Advanced Computer Architecture
18CS734	User Interface Design

Professional Electives – 3

Course code under 18CS74X	**Course Title**
18CS741	Digital Image Processing
18CS742	Network management
18CS743	Natural Language Processing
18CS744	Cryptography
18CS745	Robotic Process Automation Design & Development

Open Elective –B (Not for CSE / ISE Programs)

18CS751	Introduction to Big Data Analytics
18CS752	Python Application Programming
18CS753	Introduction to Artificial Intelligence
18CS754	Introduction to Dot Net framework for Application Development

Students can select any one of the open electives offered by any Department (Please refer to the list of open electives under 18CS75X).
Selection of an open elective is not allowed provided,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Adviser/Mentor.

Project work: Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary project can be assigned to an individual student or to a group having not more than 4 students. In extraordinary cases, like the funded projects requiring students from different disciplines, the project student strength can be 5 or 6.

CIE procedure for Project Work Phase - 1:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work phase -1, shall be based on the evaluation of the project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the Project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work phase -1, shall be based on the evaluation of project work phase -1 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

Internship: All the students admitted to III year of BE/B.Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not takeup/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

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VIII SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	PCC	18CS81	Internet of Things	CS / IS	3	--	--	03	40	60	100	3
2	PEC	18CS82X	Professional Elective – 4	CS / IS	3	--	--	03	40	60	100	3
3	Project	18CSP83	Project Work Phase – 2	CS / IS	--	--	2	03	40	60	100	8
4	Seminar	18CSS84	Technical Seminar	CS / IS	--	--	2	03	100	--	100	1
5	INT	18CSI85	Internship	(Completed during the intervening vacations of VI and VII semesters and /or VII and VIII semesters.)				03	40	60	100	3
				TOTAL	**06**	--	**04**	**15**	**260**	**240**	**500**	**18**

Note: PCC: Professional Core, PEC: Professional Elective, OEC: Open Elective, INT: Internship.

Professional Electives – 4

Course code under 18CS82X	Course Title
18CS821	Mobile Computing
18CS822	Storage Area Networks
18CS823	NoSQL Database
18CS824	Multicore Architecture and Programming

Project Work CIE procedure for Project Work Phase - 2:
(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.
(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.
SEE for Project Work Phase - 2:
(i) Single discipline: Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted at the department.
(ii) Interdisciplinary: Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belong to.
Internship: Those, who have not pursued /completed the internship shall be declared as fail and have to complete during subsequent University examination after satisfying the internship requirements

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card. Activity points of the students who have earned the prescribed AICTE activity Points shall be sent the University along with the CIE marks of 8th semester. In case of students who have not satisfied the AICTE activity Points at the end of eighth semester, the column under activity Points shall be marked NSAP (Not Satisfied Activity Points).

MANAGEMENT AND ENTREPRENEURSHIP FOR IT INDUSTRY
(Effective from the academic year 2018 -2019)
SEMESTER – V

Course Code	**18CS51**	**CIE Marks**	40
Number of Contact Hours/Week	2:2:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03

CREDITS – 03

Course Learning Objectives: This course (18CS51) will enable students to:

- Explain the principles of management, organization and entrepreneur.
- Discuss on planning, staffing, ERP and their importance
- Infer the importance of intellectual property rights and relate the institutional support

Module – 1	Contact Hours
Introduction - Meaning, nature and characteristics of management, scope and Functional areas of management, goals of management, levels of management, brief overview of evolution of management theories,. Planning- Nature, importance, types of plans, steps in planning, Organizing- nature and purpose, types of Organization, Staffing- meaning, process of recruitment and selection **RBT: L1, L2**	08
Module – 2	
Directing and controlling- meaning and nature of directing, leadership styles, motivation Theories, Communication- Meaning and importance, Coordination- meaning and importance, Controlling- meaning, steps in controlling, methods of establishing control. **RBT: L1, L2**	08
Module – 3	
Entrepreneur – meaning of entrepreneur, characteristics of entrepreneurs, classification and types of entrepreneurs, various stages in entrepreneurial process, role of entrepreneurs in economic development, entrepreneurship in India and barriers to entrepreneurship. Identification of business opportunities, market feasibility study, technical feasibility study, financial feasibility study and social feasibility study. **RBT: L1, L2**	08
Module – 4	
Preparation of project and ERP - meaning of project, project identification, project selection, project report, need and significance of project report, contents, formulation, guidelines by planning commission for project report, **Enterprise Resource Planning: Meaning and Importance- ERP** and Functional areas of Management – Marketing / Sales- Supply Chain Management – Finance and Accounting – Human Resources – Types of reports and methods of report generation **RBT: L1, L2**	08
Module – 5	
Micro and Small Enterprises: Definition of micro and small enterprises, characteristics and advantages of micro and small enterprises, steps in establishing micro and small enterprises, Government of India indusial policy 2007 on micro and small enterprises, case study (Microsoft), Case study(Captain G R Gopinath),case study (N R Narayana Murthy & Infosys), **Institutional support:** MSME-DI, NSIC, SIDBI, KIADB, KSSIDC, TECSOK, KSFC, DIC and District level single window agency, **Introduction to IPR.**	08

RBT: L1, L2	

Course outcomes: The students should be able to:

- Define management, organization, entrepreneur, planning, staffing, ERP and outline their importance in entrepreneurship
- Utilize the resources available effectively through ERP
- Make use of IPRs and institutional support in entrepreneurship

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Principles of Management -P. C. Tripathi, P. N. Reddy; Tata McGraw Hill, 4th / 6th Edition, 2010.
2. Dynamics of Entrepreneurial Development & Management -Vasant Desai Himalaya Publishing House.
3. Entrepreneurship Development -Small Business Enterprises -Poornima M Charantimath Pearson Education – 2006.
4. Management and Entrepreneurship - Kanishka Bedi- Oxford University Press-2017

Reference Books:

1. Management Fundamentals -Concepts, Application, Skill Development Robert Lusier – Thomson.
2. Entrepreneurship Development -S S Khanka -S Chand & Co.
3. Management -Stephen Robbins -Pearson Education /PHI -17th Edition, 2003

COMPUTER NETWORKS AND SECURITY
(Effective from the academic year 2018 -2019)
SEMESTER – V

Course Code	**18CS52**	**CIE Marks**	40
Number of Contact Hours/Week	3:2:0	**SEE Marks**	60
Total Number of Contact Hours	50	**Exam Hours**	03

CREDITS –4

Course Learning Objectives: This course (18CS52) will enable students to:

- Demonstration of application layer protocols
- Discuss transport layer services and understand UDP and TCP protocols
- Explain routers, IP and Routing Algorithms in network layer
- Disseminate the Wireless and Mobile Networks covering IEEE 802.11 Standard
- Illustrate concepts of Multimedia Networking, Security and Network Management

Module 1	Contact Hours
Application Layer: Principles of Network Applications: Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols. The Web and HTTP: Overview of HTTP, Non-persistent and Persistent Connections, HTTP Message Format, User-Server Interaction: Cookies, Web Caching, The Conditional GET, File Transfer: FTP Commands & Replies, Electronic Mail in the Internet: SMTP, Comparison with HTTP, Mail Message Format, Mail Access Protocols, DNS; The Internet's Directory Service: Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages, Peer-to-Peer Applications: P2P File Distribution, Distributed Hash Tables, Socket Programming: creating Network Applications: Socket Programming with UDP, Socket Programming with TCP. **T1: Chap 2** **RBT: L1, L2, L3**	10
Module 2	
Transport Layer : Introduction and Transport-Layer Services: Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing: Connectionless Transport: UDP,UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N, Selective repeat, Connection-Oriented Transport TCP: The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control: The Causes and the Costs of Congestion, Approaches to Congestion Control, Network-assisted congestion-control example, ATM ABR Congestion control, TCP Congestion Control: Fairness. **T1: Chap 3** **RBT: L1, L2, L3**	10
Module 3	
The Network layer: What's Inside a Router?: Input Processing, Switching, Output Processing, Where Does Queuing Occur? Routing control plane, IPv6,A Brief foray into IP Security, Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing, Routing in the Internet, Intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter/AS Routing: BGP, Broadcast Routing Algorithms and Multicast. **T1: Chap 4: 4.3-4.7** **RBT: L1, L2, L3**	10

Module 4	
Network Security:Overview of Network Security:Elements of Network Security , Classification of Network Attacks ,Security Methods ,Symmetric-Key Cryptography :Data Encryption Standard (DES),Advanced Encryption Standard (AES) , Public-Key Cryptography :RSA Algorithm ,Diffie-Hellman Key-Exchange Protocol , Authentication :Hash Function , Secure Hash Algorithm (SHA) , Digital Signatures , Firewalls and Packet Filtering ,Packet Filtering , Proxy Server . **Textbook2: Chapter 10** **RBT: L1, L2, L3**	10
Module 5	
Multimedia Networking: Properties of video, properties of Audio, Types of multimedia Network Applications, Streaming stored video: UDP Streaming, HTTP Streaming, Adaptive streaming and DASH, content distribution Networks Voice-over-IP :Limitations of the Best-Effort IP Service ,Removing Jitter at the Receiver for Audio ,Recovering from Packet Loss Protocols for Real-Time Conversational Applications , RTP , SIP **Textbook11: Chap 7** **RBT: L1, L2, L3**	10

Course Outcomes: The student will be able to :

- Explain principles of application layer protocols
- Recognize transport layer services and infer UDP and TCP protocols
- Classify routers, IP and Routing Algorithms in network layer
- Understand the Wireless and Mobile Networks covering IEEE 802.11 Standard
- Describe Multimedia Networking and Network Management

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson,2017 .
2. Nader F Mir, Computer and Communication Networks, 2nd Edition, Pearson, 2014.

Reference Books:

1. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition
2. Larry L Peterson and Brusce S Davie, Computer Networks, fifth edition, ELSEVIER
3. Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson
4. Mayank Dave, Computer Networks, Second edition, Cengage Learning

<table>
<tr><td colspan="4" align="center">DATABASE MANAGEMENT SYSTEM
(Effective from the academic year 2018 -2019)
SEMESTER – V</td></tr>
<tr><td>Course Code</td><td>18CS53</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Contact Hours/Week</td><td>3:2:0</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Contact Hours</td><td>50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4" align="center">CREDITS –4</td></tr>
<tr><td colspan="4">Course Learning Objectives: This course (18CS53) will enable students to:</td></tr>
<tr><td colspan="4">Provide a strong foundation in database concepts, technology, and practice.
Practice SQL programming through a variety of database problems.
Demonstrate the use of concurrency and transactions in database
Design and build database applications for real world problems.</td></tr>
</table>

Module 1	Contact Hours
Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications. **Overview of Database Languages and Architectures:** Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment. **Conceptual Data Modelling using Entities and Relationships:** Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, examples, Specialization and Generalization. **Textbook 1:Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.10** **RBT: L1, L2, L3**	10
Module 2	
Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations. **Relational Algebra:** Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra. **Mapping Conceptual Design into a Logical Design:** Relational Database Design using ER-to-Relational mapping. **SQL:** SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL. **Textbook 1: Ch4.1 to 4.5, 5.1 to 5.3, 6.1 to 6.5, 8.1; Textbook 2: 3.5** **RBT: L1, L2, L3**	10
Module 3	
SQL : Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL. **Database Application Development:** Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Case study: The internet Bookshop. **Internet Applications:** The three-Tier application architecture, The presentation layer, The Middle Tier **Textbook 1: Ch7.1 to 7.4; Textbook 2: 6.1 to 6.6, 7.5 to 7.7.** **RBT: L1, L2, L3**	10
Module 4	
Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. **Normalization Algorithms:** Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational	10

Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms **Textbook 1: Ch14.1 to 14.7, 15.1 to 15.6** **RBT: L1, L2, L3**	
Module 5	
Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL. **Concurrency Control in Databases:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking. **Introduction to Database Recovery Protocols:** Recovery Concepts, NO-UNDO/REDO recovery based on Deferred update, Recovery techniques based on immediate update, Shadow paging, Database backup and recovery from catastrophic failures **Textbook 1: 20.1 to 20.6, 21.1 to 21.7, 22.1 to 22.4, 22.7.** **RBT: L1, L2, L3**	10

Course Outcomes: The student will be able to :

- Identify, analyze and define database objects, enforce integrity constraints on a database using RDBMS.
- Use Structured Query Language (SQL) for database manipulation.
- Design and build simple database systems
- Develop application to interact with databases.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.
2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill

Reference Books:

1. Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, Mc-GrawHill, 2013.
2. Coronel, Morris, and Rob, Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 2012.

AUTOMATA THEORY AND COMPUTABILITY
(Effective from the academic year 2018 -2019)
SEMESTER – V

Course Code	18CS54	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03

CREDITS –3

Course Learning Objectives: This course (18CS54) will enable students to:

- Introduce core concepts in Automata and Theory of Computation
- Identify different Formal language Classes and their Relationships
- Design Grammars and Recognizers for different formal languages
- Prove or disprove theorems in automata theory using their properties
- Determine the decidability and intractability of Computational problems

Module 1	**Contact Hours**
Why study the Theory of Computation, Languages and Strings: Strings, Languages. A Language Hierarchy, Computation, **Finite State Machines (FSM)**: Deterministic FSM, Regular languages, Designing FSM, Nondeterministic FSMs, From FSMs to Operational Systems, Simulators for FSMs, Minimizing FSMs, Canonical form of Regular languages, Finite State Transducers, Bidirectional Transducers. **Textbook 1: Ch 1,2, 3,4, 5.1 to 5.10** **RBT: L1, L2**	08
Module 2	
Regular Expressions (RE): what is a RE?, Kleene's theorem, Applications of REs, Manipulating and Simplifying REs. Regular Grammars: Definition, Regular Grammars and Regular languages. Regular Languages (RL) and Non-regular Languages: How many RLs, To show that a language is regular, Closure properties of RLs, to show some languages are not RLs. **Textbook 1: Ch 6, 7, 8: 6.1 to 6.4, 7.1, 7.2, 8.1 to 8.4** **RBT: L1, L2, L3**	08
Module 3	
Context-Free Grammars(CFG): Introduction to Rewrite Systems and Grammars, CFGs and languages, designing CFGs, simplifying CFGs, proving that a Grammar is correct, Derivation and Parse trees, Ambiguity, Normal Forms. Pushdown Automata (PDA): Definition of non-deterministic PDA, Deterministic and Non-deterministic PDAs, Non-determinism and Halting, alternative equivalent definitions of a PDA, alternatives that are not equivalent to PDA. **Textbook 1: Ch 11, 12: 11.1 to 11.8, 12.1, 12.2, 12,4, 12.5, 12.6** **RBT: L1, L2, L3**	08
Module 4	
Algorithms and Decision Procedures for CFLs: Decidable questions, Un-decidable questions. **Turing Machine**: Turing machine model, Representation, Language acceptability by TM, design of TM, Techniques for TM construction. Variants of Turing Machines (TM), The model of Linear Bounded automata. **Textbook 1: Ch 14: 14.1, 14.2, Textbook 2: Ch 9.1 to 9.8** **RBT: L1, L2, L3**	08
Module 5	
Decidability: Definition of an algorithm, decidability, decidable languages, Undecidable languages, halting problem of TM, Post correspondence problem. Complexity: Growth rate	08

of functions, the classes of P and NP, Quantum Computation: quantum computers, Church-Turing thesis. **Applications:** G.1 Defining syntax of programming language, Appendix J: Security **Textbook 2: 10.1 to 10.7, 12.1, 12.2, 12.8, 12.8.1, 12.8.2** **Textbook 1: Appendix: G.1(only), J.1 & J.2** **RBT: L1, L2, L3**	

Course Outcomes: The student will be able to :

- Acquire fundamental understanding of the core concepts in automata theory and Theory of Computation
- Learn how to translate between different models of Computation (e.g., Deterministic and Non-deterministic and Software models).
- Design Grammars and Automata (recognizers) for different language classes and become knowledgeable about restricted models of Computation (Regular, Context Free) and their relative powers.
- Develop skills in formal reasoning and reduction of a problem to a formal model, with an emphasis on semantic precision and conciseness.
- Classify a problem with respect to different models of Computation.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Elaine Rich, Automata, Computability and Complexity, 1st Edition, Pearson education,2012/2013
2. K L P Mishra, N Chandrasekaran , 3rd Edition, Theory of Computer Science, PhI, 2012.

Reference Books:

1. John E Hopcroft, Rajeev Motwani, Jeffery D Ullman, Introduction to AutomataTheory, Languages, and Computation, 3rd Edition, Pearson Education, 2013
2. Michael Sipser : Introduction to the Theory of Computation, 3rd edition, Cengage learning,2013
3. John C Martin, Introduction to Languages and The Theory of Computation, 3rd Edition, Tata McGraw –Hill Publishing Company Limited, 2013
4. Peter Linz, "An Introduction to Formal Languages and Automata", 3rd Edition, Narosa Publishers, 1998
5. Basavaraj S. Anami, Karibasappa K G, Formal Languages and Automata theory, Wiley India, 2012
6. C K Nagpal, Formal Languages and Automata Theory, Oxford University press, 2012.

Faculty can utilize open source tools (like JFLAP) to make teaching and learning more interactive.

APPLICATION DEVELOPMENT USING PYTHON [(Effective from the academic year 2018 -2019) SEMESTER – V			
Course Code	**18CS55**	**IA Marks**	40
Number of Lecture Hours/Week	03	**Exam Marks**	60
Total Number of Lecture Hours	40	**Exam Hours**	03

CREDITS – 03

Course Learning Objectives: This course (18CS55) will enable students to

- Learn the syntax and semantics of Python programming language.
- Illustrate the process of structuring the data using lists, tuples and dictionaries.
- Demonstrate the use of built-in functions to navigate the file system.
- Implement the Object Oriented Programming concepts in Python.
- Appraise the need for working with various documents like Excel, PDF, Word and Others.

Module – 1	Teaching Hours
Python Basics, Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program,**Flow control,** Boolean Values, Comparison Operators, Boolean Operators,Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules,Ending a Program Early with sys.exit(), **Functions,** def Statements with Parameters, Return Values and return Statements,The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling, A Short Program: Guess the Number **Textbook 1: Chapters 1 – 3** **RBT: L1, L2**	08
Module – 2	
Lists, The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples,References, **Dictionaries and Structuring Data,** The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things, **Manipulating Strings,** Working with Strings, Useful String Methods, Project: Password Locker, Project: Adding Bullets to Wiki Markup **Textbook 1: Chapters 4 – 6** **RBT: L1, L2, L3**	08
Module – 3	
Pattern Matching with Regular Expressions, Finding Patterns of Text Without Regular Expressions, Finding Patterns of Text with Regular Expressions,More Pattern Matching with Regular Expressions, Greedy and Nongreedy Matching, The findall() Method, Character Classes, Making Your Own Character Classes, The Caret and Dollar Sign Characters, The Wildcard Character, Review of Regex Symbols, Case-Insensitive Matching, Substituting Strings with the sub() Method, Managing Complex Regexes, Combining re .IGNORECASE, re .DOTALL, and re .VERBOSE, Project: Phone Number and Email Address Extractor, **Reading and Writing Files,** Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module,Saving Variables with the pprint.pformat() Function, Project: Generating Random Quiz Files, Project: Multiclipboard, **Organizing Files,** The shutil Module, Walking a Directory Tree, Compressing Files with the zipfile Module, Project: Renaming Files with American-Style Dates to European-Style Dates,Project: Backing Up a Folder into a ZIP File, **Debugging,** Raising Exceptions, Getting the Traceback as a String, Assertions, Logging, IDLE's Debugger. **Textbook 1: Chapters 7 – 10**	08

RBT: L1, L2, L3	
Module – 4	
Classes and objects, Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying, **Classes and functions,** Time, Pure functions, Modifiers, Prototyping versus planning, **Classes and methods,** Object-oriented features, Printing objects, Another example, A more complicated example,The init method, The __str__ method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation,**Inheritance,** Card objects, Class attributes, Comparing cards, Decks, Printing the deck, Add, remove, shuffle and sort, Inheritance, Class diagrams, Data encapsulation **Textbook 2: Chapters 15 – 18** **RBT: L1, L2, L3**	08
Module – 5	
Web Scraping, Project: MAPIT.PY with the webbrowser Module, Downloading Files from the Web with the requests Module, Saving Downloaded Files to the Hard Drive, HTML, Parsing HTML with the BeautifulSoup Module, Project: "I'm Feeling Lucky" Google Search,Project: Downloading All XKCD Comics, Controlling the Browser with the selenium Module, **Working with Excel Spreadsheets,** Excel Documents, Installing the openpyxl Module, Reading Excel Documents, Project: Reading Data from a Spreadsheet, Writing Excel Documents, Project: Updating a Spreadsheet, Setting the Font Style of Cells, Font Objects, Formulas, Adjusting Rows and Columns, Charts, **Working with PDF and Word Documents,** PDF Documents, Project: Combining Select Pages from Many PDFs, Word Documents, **Working with CSV files and JSON data,** The csv Module, Project: Removing the Header from CSV Files, JSON and APIs, The json Module, Project: Fetching Current Weather Data **Textbook 1: Chapters 11 – 14** **RBT: L1, L2, L3**	08

Course Outcomes: After studying this course, students will be able to

- Demonstrate proficiency in handling of loops and creation of functions.
- Identify the methods to create and manipulate lists, tuples and dictionaries.
- Discover the commonly used operations involving regular expressions and file system.
- Interpret the concepts of Object-Oriented Programming as used in Python.
- Determine the need for scraping websites and working with CSV, JSON and other file formats.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Al Sweigart,**"Automate the Boring Stuff with Python",**1st Edition, No Starch Press, 2015. (Available under CC-BY-NC-SA license at https://automatetheboringstuff.com/)
(Chapters 1 to 18)
2. Allen B. Downey, **"Think Python: How to Think Like a Computer Scientist",** 2nd Edition, Green Tea Press, 2015. (Available under CC-BY-NC license at http://greenteapress.com/thinkpython2/thinkpython2.pdf)
(Chapters 13, 15, 16, 17, 18) (Download pdf/html files from the above links)

Reference Books:

1. Gowrishankar S, Veena A, **"Introduction to Python Programming",** 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372

2. Jake VanderPlas, **"Python Data Science Handbook: Essential Tools for Working with Data",** 1st Edition, O'Reilly Media, 2016. ISBN-13: 978-1491912058
3. Charles Dierbach, **"Introduction to Computer Science Using Python",** 1st Edition, Wiley India Pvt Ltd, 2015. ISBN-13: 978-8126556014
4. Wesley J Chun, **"Core Python Applications Programming",** 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365

UNIX PROGRAMMING
(Effective from the academic year 2018 -2019)
SEMESTER – V

Course Code	**18CS56**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03

CREDITS – 3

Course Learning Objectives: This course (18CS56) will enable students to

- Interpret the features of UNIX and basic commands.
- Demonstrate different UNIX files and permissions
- Implement shell programs.
- Explain UNIX process, IPC and signals.

Module 1	Contact Hours
Introduction: Unix Components/Architecture. Features of Unix. The UNIX Environment and UNIX Structure, Posix and Single Unix specification. General features of Unix commands/ command structure. Command arguments and options. Basic Unix commands such as echo, printf, ls, who, date,passwd, cal, Combining commands. Meaning of Internal and external commands. The type command: knowing the type of a command and locating it. The root login. Becoming the super user: su command. **Unix files:** Naming files. Basic file types/categories. Organization of files. Hidden files. Standard directories. Parent child relationship. The home directory and the HOME variable. Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames. Directory commands – pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names. File related commands – cat, mv, rm, cp, wc and od commands. **RBT: L1, L2**	08
Module 2	
File attributes and permissions: The ls command with options. Changing file permissions: the relative and absolute permissions changing methods. Recursively changing file permissions. Directory permissions. **The shells interpretive cycle:** Wild cards. Removing the special meanings of wild cards. Three standard files and redirection. **Connecting commands:** Pipe. Basic and Extended regular expressions. The grep, egrep. Typical examples involving different regular expressions. **Shell programming:** Ordinary and environment variables. The .profile. Read and readonly commands. Command line arguments. exit and exit status of a command. Logical operators for conditional execution. The test command and its shortcut. The if, while, for and case control statements. The set and shift commands and handling positional parameters. The here (<<) document and trap command. Simple shell program examples. **RBT: L1, L2**	08
Module 3	
UNIX File APIs: General File APIs, File and Record Locking, Directory File APIs, Device File APIs, FIFO File APIs, Symbolic Link File APIs. **UNIX Processes and Process Control:** **The Environment of a UNIX Process:** Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions, UNIX Kernel Support for Processes. **Process Control:** Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3,	08

wait4 Functions, Race Conditions, exec Functions **RBT: L1, L2, L3**	
Module 4	
Changing User IDs and Group IDs, Interpreter Files, system Function, Process Accounting, User Identification, Process Times, I/O Redirection. **Overview of IPC Methods**, Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores. **Shared Memory**, Client-Server Properties, Stream Pipes, Passing File Descriptors, An Open Server-Version 1, Client-Server Connection Functions. **RBT: L1, L2, L3**	08
Module 5	
Signals and Daemon Processes: Signals: The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, The SIGCHLD Signal and the waitpid Function, The sigsetjmp and siglongjmp Functions, Kill, Alarm, Interval Timers, POSIX.lb Timers. Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model. **RBT: L1, L2, L3**	08

Course Outcomes: The student will be able to :

- Explain Unix Architecture, File system and use of Basic Commands
- Illustrate Shell Programming and to write Shell Scripts
- Categorize, compare and make use of Unix System Calls
- Build an application/service over a Unix system.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Sumitabha Das., Unix Concepts and Applications., 4thEdition., Tata McGraw Hill (Chapter 1,2 ,3,4,5,6,8,13,14)
2. W. Richard Stevens: Advanced Programming in the UNIX Environment, 2nd Edition, Pearson Education, 2005 (Chapter 3,7,8,10,13,15)
3. Unix System Programming Using C++ - Terrence Chan, PHI, 1999. (Chapter 7,8,9,10)

Reference Books:

1. M.G. Venkatesh Murthy: UNIX & Shell Programming**,** Pearson Education.
2. Richard Blum , Christine Bresnahan : Linux Command Line and Shell Scripting Bible, 2ndEdition, Wiley,2014.

Faculty can utilize open source tools to make teaching and learning more interactive.

COMPUTER NETWORK LABORATORY
(Effective from the academic year 2018 -2019)
SEMESTER – V

Course Code	**18CSL57**	**CIE Marks**	40
Number of Contact Hours/Week	0:2:2	**SEE Marks**	60
Total Number of Lab Contact Hours	36	**Exam Hours**	03

Credits – 2

Course Learning Objectives: This course (18CSL57) will enable students to:

- Demonstrate operation of network and its management commands
- Simulate and demonstrate the performance of GSM and CDMA
- Implement data link layer and transport layer protocols.

Descriptions (if any):

- For the experiments below modify the topology and parameters set for the experiment and take multiple rounds of reading and analyze the results available in log files. Plot necessary graphs and conclude. Use NS2/NS3.
- **Installation procedure of the required software must be demonstrated, carried out in groups and documented in the journal.**

Programs List:

	PART A
1.	Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped.
2.	Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
3.	Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
4.	Implement simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets.
5.	Implement and study the performance of GSM on NS2/NS3 (Using MAC layer) or equivalent environment.
6.	Implement and study the performance of CDMA on NS2/NS3 (Using stack called Call net) or equivalent environment
	PART B (Implement the following in Java)
7.	Write a program for error detecting code using CRC-CCITT (16- bits).
8.	Write a program to find the shortest path between vertices using bellman-ford algorithm.
9.	Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present.
10.	Write a program on datagram socket for client/server to display the messages on client side, typed at the server side.
11.	Write a program for simple RSA algorithm to encrypt and decrypt the data.
12.	Write a program for congestion control using leaky bucket algorithm.

Laboratory Outcomes: The student should be able to:

- Analyze and Compare various networking protocols.
- Demonstrate the working of different concepts of networking.
- Implement, analyze and evaluate networking protocols in NS2 / NS3 and JAVA programming language

Conduct of Practical Examination:

- Experiment distribution

- For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
- For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.

- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution *(Courseed to change in accoradance with university regulations)*
  i) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
  j) For laboratories having PART A and PART B
     i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
     ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

DBMS LABORATORY WITH MINI PROJECT

(Effective from the academic year 2018 -2019)

SEMESTER – V

Course Code	**18CSL58**	**CIE Marks**	40
Number of Contact Hours/Week	0:2:2	**SEE Marks**	60
Total Number of Lab Contact Hours	36	**Exam Hours**	03

Credits – 2

Course Learning Objectives: This course (18CSL58) will enable students to:

- Foundation knowledge in database concepts, technology and practice to groom students into well-informed database application developers.
- Strong practice in SQL programming through a variety of database problems.
- Develop database applications using front-end tools and back-end DBMS.

Descriptions (if any):

PART-A: SQL Programming (Max. Exam Mks. 50)

- Design, develop, and implement the specified queries for the following problems using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment.
- Create Schema and insert at least 5 records for each table. Add appropriate database constraints.

PART-B: Mini Project (Max. Exam Mks. 30)

- Use Java, C#, PHP, Python, or any other similar front-end tool. All applications must be demonstrated on desktop/laptop as a stand-alone or web based application (Mobile apps on Android/IOS are not permitted.)

Installation procedure of the required software must be demonstrated, carried out in groups and documented in the journal.

Programs List:

PART A

1. Consider the following schema for a Library Database:
BOOK(Book_id, Title, Publisher_Name, Pub_Year)
BOOK_AUTHORS(Book_id, Author_Name)
PUBLISHER(Name, Address, Phone)
BOOK_COPIES(Book_id, Programme_id, No-of_Copies)
BOOK_LENDING(Book_id, Programme_id, Card_No, Date_Out, Due_Date)
LIBRARY_PROGRAMME(Programme_id, Programme_Name, Address)
Write SQL queries to
   1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each Programme, etc.
   2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017.
   3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.
   4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query.
   5. Create a view of all books and its number of copies that are currently available in the Library.

2. Consider the following schema for Order Database:
SALESMAN(Salesman_id, Name, City, Commission)
CUSTOMER(Customer_id, Cust_Name, City, Grade, Salesman_id)
ORDERS(Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)
Write SQL queries to
   1. Count the customers with grades above Bangalore's average.

	2. Find the name and numbers of all salesman who had more than one customer. 3. List all the salesman and indicate those who have and don't have customers in their cities (Use UNION operation.) 4. Create a view that finds the salesman who has the customer with the highest order of a day. 5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.
3.	Consider the schema for Movie Database: ACTOR(Act_id, Act_Name, Act_Gender) DIRECTOR(Dir_id, Dir_Name, Dir_Phone) MOVIES(Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id) MOVIE_CAST(Act_id, Mov_id, Role) RATING(Mov_id, Rev_Stars) Write SQL queries to 1. List the titles of all movies directed by 'Hitchcock'. 2. Find the movie names where one or more actors acted in two or more movies. 3. List all actors who acted in a movie before 2000 and also in a movie after 2015 (use JOIN operation). 4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title. 5. Update rating of all movies directed by 'Steven Spielberg' to 5.
4.	Consider the schema for College Database: STUDENT(USN, SName, Address, Phone, Gender) SEMSEC(SSID, Sem, Sec) CLASS(USN, SSID) COURSE(Subcode, Title, Sem, Credits) IAMARKS(USN, Subcode, SSID, Test1, Test2, Test3, FinalIA) Write SQL queries to 1. List all the student details studying in fourth semester 'C' section. 2. Compute the total number of male and female students in each semester and in each section. 3. Create a view of Test1 marks of student USN '1BI15CS101' in all Courses. 4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students. 5. Categorize students based on the following criterion: If FinalIA = 17 to 20 then CAT = 'Outstanding' If FinalIA = 12 to 16 then CAT = 'Average' If FinalIA< 12 then CAT = 'Weak' Give these details only for 8^{th} semester A, B, and C section students.
5.	Consider the schema for Company Database: EMPLOYEE(SSN, Name, Address, Sex, Salary, SuperSSN, DNo) DEPARTMENT(DNo, DName, MgrSSN, MgrStartDate) DLOCATION(DNo,DLoc) PROJECT(PNo, PName, PLocation, DNo) WORKS_ON(SSN, PNo, Hours) Write SQL queries to 1. Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project. 2. Show the resulting salaries if every employee working on the 'IoT' project is

	given a 10 percent raise. 3. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department 4. Retrieve the name of each employee who works on all the projects controlledby department number 5 (use NOT EXISTS operator). 5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6,00,000.
PART B: Mini Project	
•	For any problem selected
•	Make sure that the application should have five or more tables
•	Indicative areas include; health care

Laboratory Outcomes: The student should be able to:

- Create, Update and query on the database.
- Demonstrate the working of different concepts of DBMS
- Implement, analyze and evaluate the project developed for an application.

Conduct of Practical Examination:

- Experiment distribution
  - For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
  - For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.
- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution *(Courseed to change in accoradance with university regulations)*
  k) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
  l) For laboratories having PART A and PART B
    i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
    ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

B. E. COMMON TO ALL PROGRAMMES Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER – V			
ENVIRONMENTAL STUDIES			
Course Code	**18CIV59**	CIE Marks	40
Teaching Hours / Week (L:T:P)	(1:0:0)	SEE Marks	60
Credits	01	Exam Hours	02

Module - 1

Ecosystems (Structure and Function): Forest, Desert, Wetlands, Riverine, Oceanic and Lake.
Biodiversity: Types, Value; Hot-spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.

Module - 2

Advances in Energy Systems (Merits, Demerits, Global Status and Applications)**:** Hydrogen, Solar, OTEC, Tidal and Wind.
Natural Resource Management (Concept and case-studies): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading.

Module - 3

Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies)**:** Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution.
Waste Management & Public Health Aspects: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.

Module - 4

Global Environmental Concerns (Concept, policies and case-studies):Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.

Module - 5

Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications): G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship- NGOs.
Field work: Visit to an Environmental Engineering Laboratory or Green Building or Water Treatment Plant or Waste water treatment Plant; ought to be Followed by understanding of process and its brief documentation.

Course Outcomes: At the end of the course, students will be able to:

- CO1: Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale,
- CO2: Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
- CO3: Demonstrate ecology knowledge of a complex relationship between biotic and abiotic components.
- CO4: Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.

Question paper pattern:

- The Question paper will have 100 objective questions.
- Each question will be for 01 marks
- Student will have to answer all the questions in an OMR Sheet.
- The Duration of Exam will be 2 hours.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				

1	Environmental Studies	Benny Joseph	Tata Mc Graw – Hill.	2nd Edition, 2012
2.	Environmental Studies	S M Prakash	Pristine Publishing House, Mangalore	3rd Edition, 2018
3	Environmental Studies – From Crisis to Cure	R Rajagopalan	Oxford Publisher	2005
Reference Books				
1	Principals of Environmental Science and Engineering	Raman Sivakumar	Cengage learning, Singapur.	2nd Edition, 2005
2	Environmental Science – working with the Earth	G.Tyler Miller Jr.	Thomson Brooks /Cole,	11th Edition, 2006
3	Text Book of Environmental and Ecology	Pratiba Sing, Anoop Singh& Piyush Malaviya	Acme Learning Pvt. Ltd. New Delhi.	1st Edition

<table>
<tr><td colspan="5">SYSTEM SOFTWARE AND COMPILERS
(Effective from the academic year 2018 -2019)
SEMESTER – VI</td></tr>
<tr><td>Course Code</td><td>18CS61</td><td>CIE Marks</td><td colspan="2">40</td></tr>
<tr><td>Number of Contact Hours/Week</td><td>3:2:0</td><td>SEE Marks</td><td colspan="2">60</td></tr>
<tr><td>Total Number of Contact Hours</td><td>50</td><td>Exam Hours</td><td colspan="2">03</td></tr>
<tr><td colspan="5">CREDITS –4</td></tr>
<tr><td colspan="5">Course Learning Objectives: This course (18CS61) will enable students to:</td></tr>
<tr><td colspan="5">• Define System Software.
• Familiarize with source file, object file and executable file structures and libraries
• Describe the front-end and back-end phases of compiler and their importance to students</td></tr>
<tr><td colspan="4">Module 1</td><td>Contact Hours</td></tr>
<tr><td colspan="4">Introduction to System Software, Machine Architecture of SIC and SIC/XE. Assemblers: Basic assembler functions, machine dependent assembler features, machine independent assembler features, assembler design options. Basic Loader Functions
Text book 1: Chapter 1: 1.1,1.2,1.3.1,1.3.2, Chapter2 : 2.1 to 2.4, Chapter 3 ,3.1
RBT: L1, L2, L3</td><td>10</td></tr>
<tr><td colspan="4">Module 2</td><td></td></tr>
<tr><td colspan="4">Introduction: Language Processors, The structure of a compiler, The evaluation of programming languages, The science of building compiler, Applications of compiler technology.
Lexical Analysis: The role of lexical analyzer, Input buffering, Specifications of token, recognition of tokens.
Text book 2:Chapter 1 1.1-1.5 Chapter 3: 3.1 – 3.4
RBT: L1, L2, L3</td><td>10</td></tr>
<tr><td colspan="4">Module 3</td><td></td></tr>
<tr><td colspan="4">Syntax Analysis: Introduction, Context Free Grammars, Writing a grammar, Top Down Parsers, Bottom-Up Parsers
Text book 2: Chapter 4 4.1, 4.2 4.3 4.4 4.5
RBT: L1, L2, L3</td><td>10</td></tr>
<tr><td colspan="4">Module 4</td><td></td></tr>
<tr><td colspan="4">Lex and Yacc –The Simplest Lex Program, Grammars, Parser-Lexer Communication, A YACC Parser, The Rules Section, Running LEX and YACC, LEX and Hand- Written Lexers, Using LEX - Regular Expression, Examples of Regular Expressions, A Word Counting Program,
Using YACC – Grammars, Recursive Rules, Shift/Reduce Parsing, What YACC Cannot Parse, A YACC Parser - The Definition Section, The Rules Section, The LEXER, Compiling and Running a Simple Parser, Arithmetic Expressions and Ambiguity.
Text book 3: Chapter 1,2 and 3.
RBT: L1, L2, L3</td><td>10</td></tr>
<tr><td colspan="4">Module 5</td><td></td></tr>
<tr><td colspan="4">Syntax Directed Translation, Intermediate code generation, Code generation
Text book 2: Chapter 5.1, 5.2, 5.3, 6.1, 6.2, 8.1, 8.2
RBT: L1, L2, L3</td><td>10</td></tr>
<tr><td colspan="5">Course Outcomes: The student will be able to :</td></tr>
<tr><td colspan="5">• Explain system software
• Design and develop lexical analyzers, parsers and code generators
• Utilize lex and yacc tools for implementing different concepts of system software</td></tr>
</table>

Question Paper Pattern:
• The question paper will have ten questions. • Each full Question consisting of 20 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module.
Textbooks:
1. System Software by Leland. L. Beck, D Manjula, 3rd edition, 2012 2. Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman , Compilers-Principles, Techniques and Tools, Pearson, 2nd edition, 2007 3. Doug Brown, John Levine, Tony Mason, lex & yacc, O'Reilly Media, October 2012.
Reference Books:
1. Systems programming – Srimanta Pal , Oxford university press, 2016 2. System programming and Compiler Design, K C Louden, Cengage Learning 3. System software and operating system by D. M. Dhamdhere TMG 4. Compiler Design, K Muneeswaran, Oxford University Press 2013.

<table>
<tr><td colspan="5">COMUTER GRAPHICS AND VISUALIZATION
(Effective from the academic year 2018 -2019)
SEMESTER – VI</td></tr>
<tr><td>Course Code</td><td colspan="2">18CS62</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Contact Hours/Week</td><td colspan="2">3:2:0</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Contact Hours</td><td colspan="2">50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="5">CREDITS –4</td></tr>
<tr><td colspan="5">Course Learning Objectives: This course (18CS62) will enable students to:</td></tr>
<tr><td colspan="5">• Explain hardware, software and OpenGL Graphics Primitives.
• Illustrate interactive computer graphic using the OpenGL.
• Design and implementation of algorithms for 2D graphics Primitives and attributes.
• Demonstrate Geometric transformations, viewing on both 2D and 3D objects.
• Infer the representation of curves, surfaces, Color and Illumination models</td></tr>
<tr><td colspan="4">Module 1</td><td>Contact Hours</td></tr>
<tr><td colspan="4">Overview: Computer Graphics and OpenGL: Computer Graphics: Basics of computer graphics, Application of Computer Graphics, Video Display Devices: Random Scan and Raster Scan displays, graphics software. OpenGL: Introduction to OpenGL ,coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions, Line drawing algorithms(DDA, Bresenham's), circle generation algorithms (Bresenham's).
Text-1:Chapter -1: 1-1 to 1-9, 2-1(page 39 to 41),2.8,2.9,3-1 to 3-5,3-9,3-20
RBT: L1, L2, L3</td><td>10</td></tr>
<tr><td colspan="4">Module 2</td><td></td></tr>
<tr><td colspan="4">Fill area Primitives, 2D Geometric Transformations and 2D viewing: Fill area Primitives: Polygon fill-areas, OpenGL polygon fill area functions, fill area attributes, general scan line polygon fill algorithm, OpenGL fill-area attribute functions. 2DGeometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates. Inverse transformations, 2DComposite transformations, other 2D transformations, raster methods for geometric transformations, OpenGL raster transformations, OpenGL geometric transformations function, 2D viewing: 2D viewing pipeline, OpenGL 2D viewing functions.
Text-1:Chapter 3-14 to 3-16,4-9,4-10,4-14,5-1 to 5-7,5-17,6-1,6-4
RBT: L1, L2, L3</td><td>10</td></tr>
<tr><td colspan="4">Module 3</td><td></td></tr>
<tr><td colspan="4">Clipping,3D Geometric Transformations, Color and Illumination Models: Clipping: clipping window, normalization and viewport transformations, clipping algorithms,2D point clipping, 2D line clipping algorithms: cohen-sutherland line clipping only -polygon fill area clipping: Sutherland-Hodgeman polygon clipping algorithm only.3DGeometric Transformations: 3D translation, rotation, scaling, composite 3D transformations, other 3D transformations, affine transformations, OpenGL geometric transformations functions. Color Models: Properties of light, color models, RGB and CMY color models. Illumination Models: Light sources, basic illumination models-Ambient light, diffuse reflection, specular and phong model, Corresponding openGL functions.
Text-1:Chapter :6-2 to 6-08 (Excluding 6-4),5-9 to 5-17(Excluding 5-15),12-1,12-2,12-4,12-6,10-1,10-3
RBT: L1, L2, L3</td><td>10</td></tr>
<tr><td colspan="4">Module 4</td><td></td></tr>
<tr><td colspan="4">3D Viewing and Visible Surface Detection: 3DViewing:3D viewing concepts, 3D viewing</td><td>10</td></tr>
</table>

pipeline, 3D viewing coordinate parameters , Transformation from world to viewing coordinates, Projection transformation, orthogonal projections, perspective projections, The viewport transformation and 3D screen coordinates. OpenGL 3D viewing functions. Visible Surface Detection Methods: Classification of visible surface Detection algorithms, depth buffer method only and OpenGL visibility detection functions. **Text-1:Chapter: 7-1 to 7-10(Excluding 7-7), 9-1,9-3, 9-14** **RBT: L1, L2, L3**	
Module 5	
Input& interaction, Curves and Computer Animation: Input and Interaction: Input devices, clients and servers, Display Lists, Display Lists and Modeling, Programming Event Driven Input, Menus Picking, Building Interactive Models, Animating Interactive programs, Design of Interactive programs, Logic operations .Curved surfaces, quadric surfaces, OpenGL Quadric-Surface and Cubic-Surface Functions, Bezier Spline Curves, Bezier surfaces, OpenGL curve functions. Corresponding openGL functions. **Text-1:Chapter :8-3 to 8-6 (Excluding 8-5),8-9,8-10,8-11,3-8,8-18,13-11,3-2,13-3,13-4,13-10** **Text-2:Chapter 3: 3-1 to 3.11: Input& interaction** **RBT: L1, L2, L3**	10

Course Outcomes: The student will be able to :

- Design and implement algorithms for 2D graphics primitives and attributes.
- Illustrate Geometric transformations on both 2D and 3D objects.
- Apply concepts of clipping and visible surface detection in 2D and 3D viewing, and Illumination Models.
- Decide suitable hardware and software for developing graphics packages using OpenGL.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Donald Hearn & Pauline Baker: Computer Graphics with OpenGL Version,3^{rd} / 4^{th} Edition, Pearson Education,2011
2. Edward Angel: Interactive Computer Graphics- A Top Down approach with OpenGL, 5^{th} edition. Pearson Education, 2008

Reference Books:

1. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: pearson education
2. Xiang, Plastock : Computer Graphics , sham's outline series, 2^{nd} edition, TMG.
3. Kelvin Sung, Peter Shirley, steven Baer : Interactive Computer Graphics, concepts and applications, Cengage Learning
4. M M Raikar & Shreedhara K S Computer Graphics using OpenGL, Cengage publication

<table>
<tr><td colspan="5">WEB TECHNOLOGY AND ITS APPLICATIONS
(Effective from the academic year 2018 -2019)
SEMESTER – VI</td></tr>
<tr><td>Course Code</td><td>18CS63</td><td>CIE Marks</td><td colspan="2">40</td></tr>
<tr><td>Number of Contact Hours/Week</td><td>3:2:0</td><td>SEE Marks</td><td colspan="2">60</td></tr>
<tr><td>Total Number of Contact Hours</td><td>50</td><td>Exam Hours</td><td colspan="2">03</td></tr>
<tr><td colspan="5">CREDITS –4</td></tr>
<tr><td colspan="5">Course Learning Objectives: This course (18CS63) will enable students to:</td></tr>
<tr><td colspan="5">• Illustrate the Semantic Structure of HTML and CSS
• Compose forms and tables using HTML and CSS
• Design Client-Side programs using JavaScript and Server-Side programs using PHP
• Infer Object Oriented Programming capabilities of PHP
• Examine JavaScript frameworks such as jQuery and Backbone</td></tr>
<tr><td colspan="4">Module 1</td><td>Contact Hours</td></tr>
<tr><td colspan="4">Introduction to HTML, What is HTML and Where did it come from?, HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements, Introduction to CSS, What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling.
Textbook 1: Ch. 2, 3
RBT: L1, L2, L3</td><td>10</td></tr>
<tr><td colspan="4">Module 2</td><td></td></tr>
<tr><td colspan="4">HTML Tables and Forms, Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility, Microformats, Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks.
Textbook 1: Ch. 4,5
RBT: L1, L2, L3</td><td>10</td></tr>
<tr><td colspan="4">Module 3</td><td></td></tr>
<tr><td colspan="4">JavaScript: Client-Side Scripting, What is JavaScript and What can it do?, JavaScript Design Principles, Where does JavaScript Go?, Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms, Introduction to Server-Side Development with PHP, What is Server-Side Development, A Web Server’s Responsibilities, Quick Tour of PHP, Program Control, Functions
Textbook 1: Ch. 6, 8
RBT: L1, L2, L3</td><td>10</td></tr>
<tr><td colspan="4">Module 4</td><td></td></tr>
<tr><td colspan="4">PHP Arrays and Superglobals, Arrays, $_GET and $_POST Superglobal Arrays, $_SERVER Array, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design, Error Handling and Validation, What are Errors and Exceptions?, PHP Error Reporting, PHP Error and Exception Handling
Textbook 1: Ch. 9, 10
RBT: L1, L2, L3</td><td>10</td></tr>
<tr><td colspan="4">Module 5</td><td></td></tr>
<tr><td colspan="4">Managing State, The Problem of State in Web Applications, Passing Information via Query Strings, Passing Information via the URL Path, Cookies, Serialization, Session State, HTML5 Web Storage, Caching, Advanced JavaScript and jQuery, JavaScript Pseudo-Classes, jQuery Foundations, AJAX, Asynchronous File Transmission, Animation, Backbone</td><td>10</td></tr>
</table>

MVC Frameworks, XML Processing and Web Services, XML Processing, JSON, Overview of Web Services. **Textbook 1: Ch. 13, 15,17** **RBT: L1, L2, L3**	

Course Outcomes: The student will be able to :

- Adapt HTML and CSS syntax and semantics to build web pages.
- Construct and visually format tables and forms using HTML and CSS
- Develop Client-Side Scripts using JavaScript and Server-Side Scripts using PHP to generate and display the contents dynamically.
- Appraise the principles of object oriented development using PHP
- Inspect JavaScript frameworks like jQuery and Backbone which facilitates developer to focus on core features.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Randy Connolly, Ricardo Hoar, **"Fundamentals of Web Development",** 1st Edition, Pearson Education India. (**ISBN:**978-9332575271)

Reference Books:

1. Robin Nixon, **"Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5",** 4th Edition, O'Reilly Publications, 2015. (**ISBN:**978-9352130153)
2. Luke Welling, Laura Thomson, **"PHP and MySQL Web Development",** 5th Edition, Pearson Education, 2016. (**ISBN:**978-9332582736)
3. Nicholas C Zakas, **"Professional JavaScript for Web Developers",** 3rd Edition, Wrox/Wiley India, 2012. (**ISBN:**978-8126535088)
4. David Sawyer Mcfarland, **"JavaScript & jQuery: The Missing Manual",** 1st Edition, O'Reilly/Shroff Publishers & Distributors Pvt Ltd, 2014

Mandatory Note:

Distribution of CIE Marks is a follows (Total 40 Marks):

- 20 Marks through IA Tests
- 20 Marks through practical assessmen

Maintain a copy of the report for verification during LIC visit.

Posssible list of practicals:

1. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient.
2. Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format.
3. Write a JavaScript code that displays text "TEXT-GROWING" with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays "TEXT-SHRINKING" in BLUE color. Then the font size decreases to 5pt.
4. Develop and demonstrate a HTML5 file that includes JavaScript script that uses functions for the following problems:
   a. Parameter: A string
   b. Output: The position in the string of the left-most vowel

c. Parameter: A number
d. Output: The number with its digits in the reverse order

5. Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include USN, Name, and Name of the College, Programme, Year of Joining, and email id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.
6. Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.
7. Write a PHP program to display a digital clock which displays the current time of the server.
8. Write the PHP programs to do the following:
   a. Implement simple calculator operations.
   b. Find the transpose of a matrix.
   c. Multiplication of two matrices.
   d. Addition of two matrices.
9. Write a PHP program named states.py that declares a variable states with value "Mississippi Alabama Texas Massachusetts Kansas". write a PHP program that does the following:
   a. Search for a word in variable states that ends in xas. Store this word in element 0 of a list named statesList.
   b. Search for a word in states that begins with k and ends in s. Perform a case-insensitive comparison. [Note: Passing re.Ias a second parameter to method compile performs a case-insensitive comparison.] Store this word in element1 of statesList.
   c. Search for a word in states that begins with M and ends in s. Store this word in element 2 of the list.
   d. Search for a word in states that ends in a. Store this word in element 3 of the list.
10. Write a PHP program to sort the student records which are stored in the database using selection sort.

DATA MINING AND DATA WAREHOUSING

(Effective from the academic year 2018 -2019)

SEMESTER – VI

Course Code	**18CS641**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03

CREDITS –3

Course Learning Objectives: This course (18CS641) will enable students to:

- Define multi-dimensional data models.
- Explain rules related to association, classification and clustering analysis.
- Compare and contrast between different classification and clustering algorithms

Module 1	Contact Hours
Data Warehousing & modeling: Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading, Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations **Textbook 2: Ch.4.1,4.2** **RBT: L1, L2, L3**	08
Module 2	
Data warehouse implementation& Data mining: Efficient Data Cube computation: An overview, Indexing OLAP Data: Bitmap index and join index, Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP. **:** Introduction: What is data mining, Challenges, Data Mining Tasks, Data: Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity. **Textbook 2: Ch.4.4** **Textbook 1: Ch.1.1,1.2,1.4, 2.1 to 2.4** **RBT: L1, L2, L3**	08
Module 3	
Association Analysis: Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns. **Textbook 1: Ch 6.1 to 6.7 (Excluding 6.4)** **RBT: L1, L2, L3**	08
Module 4	
Classification: Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers. **Textbook 1: Ch 4.3,4.6,5.1,5.2,5.3** **RBT: L1, L2, L3**	08
Module 5	
Clustering Analysis: Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph-Based Clustering, Scalable Clustering Algorithms. **Textbook 1: Ch 8.1 to 8.5, 9.3 to 9.5** **RBT: L1, L2, L3**	08

Course Outcomes: The student will be able to :

- Identify data mining problems and implement the data warehouse
- Write association rules for a given data pattern.
- Choose between classification and clustering solution.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson, First impression,2014.
2. Jiawei Han, Micheline Kamber, Jian Pei: Data Mining -Concepts and Techniques, 3rd Edition, Morgan Kaufmann Publisher, 2012.

Reference Books:

1. Sam Anahory, Dennis Murray: Data Warehousing in the Real World, Pearson,Tenth Impression,2012.
2. Michael.J.Berry,Gordon.S.Linoff: Mastering Data Mining , Wiley Edition, second edtion,2012.

OBJECT ORIENTED MODELING AND DESIGN
(Effective from the academic year 2018 -2019)
SEMESTER – VI

Course Code	**18CS642**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03

CREDITS –3

Course Learning Objectives: This course (18CS642) will enable students to:

- Describe the concepts involved in Object-Oriented modelling and their benefits.
- Demonstrate concept of use-case model, sequence model and state chart model for a given problem.
- Explain the facets of the unified process approach to design and build a Software system.
- Translate the requirements into implementation for Object Oriented design.
- Choose an appropriate design pattern to facilitate development procedure.

Module 1	**Contact Hours**
Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived Data; Packages. State Modeling: Events, States, Transistions and Conditions, State Diagrams, State diagram behaviour. **Text Book-1: 4, 5** **RBT: L1, L2**	08
Module 2	
UseCase Modelling and Detailed Requirements: Overview; Detailed object-oriented Requirements definitions; System Processes-A use case/Scenario view; Identifying Input and outputs-The System sequence diagram; Identifying Object Behaviour-The state chart Diagram; Integrated Object-oriented Models. **Text Book-2:Chapter- 6:Page 210 to 250** **RBT: L1, L2, L3**	08
Module 3	
Process Overview, System Conception and Domain Analysis: Process Overview: Development stages; Development life Cycle; System Conception: Devising a system concept; elaborating a concept; preparing a problem statement. Domain Analysis: Overview of analysis; Domain Class model: Domain state model; Domain interaction model; Iterating the analysis. **Text Book-1:Chapter- 10,11,and 12**	08
Module 4	
Use case Realization :The Design Discipline within up iterations: Object Oriented Design-The Bridge between Requirements and Implementation; Design Classes and Design within Class Diagrams; Interaction Diagrams-Realizing Use Case and defining methods; Designing with Communication Diagrams; Updating the Design Class Diagram; Package Diagrams-Structuring the Major Components; Implementation Issues for Three-Layer Design. **Text Book-2: Chapter 8: page 292 to 346** **RBT: L1, L2, L3**	08
Module 5	
Design Patterns: Introduction; what is a design pattern?, Describing design patterns, the catalogue of design patterns, Organizing the catalogue, How design patterns solve design problems, how to select a design patterns, how to use a design pattern; Creational patterns: prototype and singleton (only); structural patterns adaptor and proxy (only).	08

Text Book-3: Ch-1: 1.1, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8,Ch-3,Ch-4. **RBT: L1, L2, L3**	

Course Outcomes: The student will be able to :

- Describe the concepts of object-oriented and basic class modelling.
- Draw class diagrams, sequence diagrams and interaction diagrams to solve problems.
- Choose and apply a befitting design pattern for the given problem.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

3. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML,2nd Edition, Pearson Education,2005
4. Satzinger, Jackson and Burd: Object-Oriented Analysis & Design with the Unified Process, Cengage Learning, 2005.
5. Erich Gamma, Richard Helm, Ralph Johnson and john Vlissides: Design Patterns –Elements of Reusable Object-Oriented Software, Pearson Education,2007.

Reference Books:

1. Grady Booch et. al.: Object-Oriented Analysis and Design with Applications,3rd Edition,Pearson Education,2007.
2. 2.Frank Buschmann, RegineMeunier, Hans Rohnert, Peter Sommerlad, Michel Stal: Pattern –Oriented Software Architecture. A system of patterns , Volume 1, John Wiley and Sons.2007.
3. 3. Booch, Jacobson, Rambaugh : Object-Oriented Analysis and Design with Applications, 3rd edition, pearson, Reprint 2013

CLOUD COMPUTING AND ITS APPLICATIONS (Effective from the academic year 2018 -2019) SEMESTER – VI			
Course Code	**18CS643**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03
CREDITS –3			

Course Learning Objectives: This course (18CS643) will enable students to:

- Explain the fundamentals of cloud computing
- Illustrate the cloud application programming and aneka platform
- Contrast different cloud platforms used in industry

Module 1	**Contact Hours**
Introduction ,Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Historical Developments, Distributed Systems, Virtualization, Web 2.0, Service-Oriented Computing, Utility-Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies, Amazon Web Services (AWS), Google AppEngine, Microsoft Azure, Hadoop, Force.com and Salesforce.com, Manjrasoft Aneka Virtualization, Introduction, Characteristics of Virtualized, Environments Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples Xen: Paravirtualization, VMware: Full Virtualization, Microsoft Hyper-V **Textbook 1: Ch. 1,3** **RBT: L1, L2**	08
Module 2	
Cloud Computing Architecture, Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Definition, Cloud Interoperability and Standards Scalability and Fault Tolerance Security, Trust, and Privacy Organizational Aspects Aneka: Cloud Application Platform, Framework Overview, Anatomy of the Aneka Container, From the Ground Up: Platform Abstraction Layer, Fabric Services, foundation Services, Application Services, Building Aneka Clouds, Infrastructure Organization, Logical Organization, Private Cloud Deployment Mode, Public Cloud Deployment Mode, Hybrid Cloud Deployment Mode, Cloud Programming and Management, Aneka SDK, Management Tools **Textbook 1: Ch. 4,5** **RBT: L1, L2**	08
Module 3	
Concurrent Computing: Thread Programming, Introducing Parallelism for Single Machine Computation, Programming Applications with Threads, What is a Thread?, Thread APIs, Techniques for Parallel Computation with Threads, Multithreading with Aneka, Introducing the Thread Programming Model, Aneka Thread vs. Common Threads, Programming Applications with Aneka Threads, Aneka Threads Application Model, Domain Decomposition: Matrix Multiplication, Functional Decomposition: Sine, Cosine, and Tangent. High-Throughput Computing: Task Programming, Task Computing, Characterizing a Task,	08

Computing Categories, Frameworks for Task Computing, Task-based Application Models, Embarrassingly Parallel Applications, Parameter Sweep Applications, MPI Applications, Workflow Applications with Task Dependencies, Aneka Task-Based Programming, Task Programming Model, Developing Applications with the Task Model, Developing Parameter Sweep Application, Managing Workflows. **Textbook 1: Ch. 6, 7** **RBT: L1, L2**	
Module 4	
Data Intensive Computing: Map-Reduce Programming, What is Data-Intensive Computing?, Characterizing Data-Intensive Computations, Challenges Ahead, Historical Perspective, Technologies for Data-Intensive Computing, Storage Systems, Programming Platforms, Aneka MapReduce Programming, Introducing the MapReduce Programming Model, Example Application **Textbook 1: Ch. 8** **RBT: L1, L2**	08
Module 5	
Cloud Platforms in Industry, Amazon Web Services, Compute Services, Storage Services, Communication Services, Additional Services, Google AppEngine, Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations, Microsoft Azure, Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance. Cloud Applications Scientific Applications, Healthcare: ECG Analysis in the Cloud, Biology: Protein Structure Prediction, Biology: Gene Expression Data Analysis for Cancer Diagnosis, Geoscience: Satellite Image Processing, Business and Consumer Applications, CRM and ERP, Productivity, Social Networking, Media Applications, Multiplayer Online Gaming. **Textbook 1: Ch. 9,10** **RBT: L1, L2**	08

Course Outcomes: The student will be able to :

- Explain cloud computing, virtualization and classify services of cloud computing
- Illustrate architecture and programming in cloud
- Describe the platforms for development of cloud applications and List the application of cloud.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education

Reference Books:

1. Dan C. Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, Elsevier 2013.

ADVANCED JAVA AND J2EE (Effective from the academic year 2018 -2019) SEMESTER – VI			
Course Code	**18CS644**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03
CREDITS –3			

Course Learning Objectives: This course (18CS644) will enable students to:

- Identify the need for advanced Java concepts like Enumerations and Collections
- Construct client-server applications using Java socket API
- Make use of JDBC to access database through Java Programs
- Adapt servlets to build server side programs
- Demonstrate the use of JavaBeans to develop component-based Java software

Module 1	**Contact Hours**
Enumerations, Autoboxing and Annotations(metadata): Enumerations, Enumeration fundamentals, the values() and valueOf() Methods, java enumerations are class types, enumerations Inherits Enum, example, type wrappers, Autoboxing, Autoboxing and Methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of Warning. Annotations, Annotation basics, specifying retention policy, Obtaining Annotations at run time by use of reflection, Annotated element Interface, Using Default values, Marker Annotations, Single Member annotations, Built-In annotations. **Textbook 1: Lesson 12** **RBT: L1, L2, L3**	08
Module 2	
The collections and Framework: Collections Overview, Recent Changes to Collections, The Collection Interfaces, The Collection Classes, Accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working With Maps, Comparators, The Collection Algorithms, Why Generic Collections?, The legacy Classes and Interfaces, Parting Thoughts on Collections. **Text Book 1: Ch.17** **RBT: L1, L2, L3**	08
Module 3	
String Handling **:**The String Constructors, String Length, Special String Operations, String Literals, String Concatenation, String Concatenation with Other Data Types, String Conversion and toString( ) Character Extraction, charAt( ), getChars( ), getBytes( ) toCharArray(), String Comparison, equals( ) and equalsIgnoreCase( ), regionMatches( ) startsWith( ) and endsWith( ), equals( ) Versus == , compareTo( ) Searching Strings, Modifying a String, substring( ), concat( ), replace( ), trim( ), Data Conversion Using valueOf( ), Changing the Case of Characters Within a String, Additional String Methods, StringBuffer , StringBuffer Constructors, length( ) and capacity( ), ensureCapacity( ), setLength( ), charAt( ) and setCharAt( ), getChars( ),append( ), insert( ), reverse( ), delete( ) and deleteCharAt( ), replace( ), substring( ), Additional StringBuffer Methods, StringBuilder **Text Book 1: Ch 15** **RBT: L1, L2, L3**	08
Module 4	

Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Javax.servlet Package; Reading Servlet Parameter; The Javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking. Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects **Text Book 1: Ch 31 Text Book 2: Ch 11** **RBT: L1, L2, L3**	08
Module 5	
The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions. **Text Book 2: Ch 06** **RBT: L1, L2, L3**	08

Course Outcomes: The student will be able to :

- Interpret the need for advanced Java concepts like enumerations and collections in developing modular and efficient programs
- Build client-server applications and TCP/IP socket programs
- Illustrate database access and details for managing information using the JDBC API
- Describe how servlets fit into Java-based web application architecture
- Develop reusable software components using Java Beans

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Herbert Schildt: JAVA the Complete Reference, 7^{th}/9th Edition, Tata McGraw Hill, 2007.
2. Jim Keogh: J2EE-TheCompleteReference, McGraw Hill, 2007.

Reference Books:

1. Y. Daniel Liang: Introduction to JAVA Programming, 7^{th}Edition, Pearson Education, 2007.
2. Stephanie Bodoff et al: The J2EE Tutorial, 2^{nd} Edition, Pearson Education,2004.
3. Uttam K Roy, Advanced JAVA programming, Oxford University press, 2015.

SYSTEM MODELLING AND SIMULATION (Effective from the academic year 2018 -2019) SEMESTER – VI			
Course Code	**18CS645**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03
CREDITS –3			

Course Learning Objectives: This course (18CS645) will enable students to:

- Explain the basic system concept and definitions of system;
- Discuss techniques to model and to simulate various systems;
- Analyze a system and to make use of the information to improve the performance.

Module 1	Contact Hours
Introduction: When simulation is the appropriate tool and when it is not appropriate, Advantages and disadvantages of Simulation; Areas of application, Systems and system environment; Components of a system; Discrete and continuous systems, Model of a system; Types of Models, Discrete-Event System Simulation Simulation examples: Simulation of queuing systems. **General Principles.** **Textbook 1: Ch. 1, 2, 3.1.1, 3.1.3** **RBT: L1, L2, L3**	08
Module 2	
Statistical Models in Simulation :Review of terminology and concepts, Useful statistical models,Discrete distributions. Continuous distributions,Poisson process, Empirical distributions. **Queuing Models:**Characteristics of queuing systems,Queuing notation,Long-run measures of performance of queuing systems,Long-run measures of performance of queuing systems cont…,Steady-state behavior of M/G/1 queue, Networks of queues, **Textbook 1: Ch. 5,6.1 to 6.3, 6.4.1,6.6** **RBT: L1, L2, L3**	08
Module 3	
Random-NumberGeneration: Properties of random numbers; Generation of pseudo-random numbers, Techniques for generating random numbers,Tests for Random Numbers, **Random-Variate Generation:** ,Inverse transform technique Acceptance-Rejection technique. **Textbook 1: Ch. 7,8.1, 8.2** **RBT: L1, L2, L3**	08
Module 4	
Input Modeling: Data Collection; Identifying the distribution with data, Parameter estimation, Goodness of Fit Tests, Fitting a non-stationary Poisson process, Selecting input models without data, Multivariate and Time-Series input models. **Estimation of Absolute Performance:** Types of simulations with respect to output analysis ,Stochastic nature of output data, Measures of performance and their estimation, **Contd..** **Textbook 1: Ch. 9, 11.1 to 11.3** **RBT: L1, L2, L3**	08
Module 5	
Measures of performance and their estimation,Output analysis for terminating simulations Continued..,Output analysis for steady-state simulations. **Verification, Calibration And Validation:** Optimization: Model building, verification and validation, Verification of simulation models, Verification of simulation models,Calibration and validation of models, Optimization via Simulation.	08

Textbook 1: Ch. 11.4, 11.5, 10 **RBT: L1, L2, L3**	

Course Outcomes: The student will be able to :

- Explain the system concept and apply functional modeling method to model the activities of a static system
- Describe the behavior of a dynamic system and create an analogous model for a dynamic system;
- Simulate the operation of a dynamic system and make improvement according to the simulation results.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 5 th Edition, Pearson Education, 2010.

Reference Books:

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

MOBILE APPLICATION DEVELOPMENT (OPEN ELECTIVE) (Effective from the academic year 2018 -2019) SEMESTER – VI			
Course Code	**18CS651**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03

CREDITS –3

Course Learning Objectives: This course (18CS651) will enable students to:

- Learn to setup Android application development environment
- Illustrate user interfaces for interacting with apps and triggering actions
- Interpret tasks used in handling multiple activities
- Identify options to save persistent application data
- Appraise the role of security and performance in Android applications

Module – 1	**Teaching Hours**
Get started, Build your first app, Activities, Testing, debugging and using support libraries **Textbook 1: Lesson 1,2,3** **RBT: L1, L2**	08
Module – 2	
User Interaction, Delightful user experience, Testing your UI **Textbook 1: Lesson 4,5,6** **RBT: L1, L2**	08
Module – 3	
Background Tasks, Triggering, scheduling and optimizing background tasks **Textbook 1: Lesson 7,8** **RBT: L1, L2**	08
Module – 4	
All about data, Preferences and Settings, Storing data using SQLite, Sharing data with content providers, Loading data using Loaders **Textbook 1: Lesson 9,10,11,12** **RBT: L1, L2**	08
Module – 5	
Permissions, Performance and Security, Firebase and AdMob, Publish// **Textbook 1: Lesson 13,14,15** **RBT: L1, L2**	08

Course outcomes: The students should be able to:

- Create, test and debug Android application by setting up Android development environment
- Implement adaptive, responsive user interfaces that work across a wide range of devices.
- Infer long running tasks and background work in Android applications
- Demonstrate methods in storing, sharing and retrieving data in Android applications
- Analyze performance of android applications and understand the role of permissions and security
- Describe the steps involved in publishing Android application to share with the world

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks

- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017. https://www.gitbook.com/book/google-developer-training/android-developer-fundamentals-course-concepts/details (Download pdf file from the above link)

Reference Books:

1. Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd, 2014.
2. Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, O'Reilly SPD Publishers, 2015.
3. J F DiMarzio, "Beginning Android Programming with Android Studio", 4th Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126565580
4. Anubhav Pradhan, Anil V Deshpande, " Composing Mobile Apps" using Android, Wiley 2014, ISBN: 978-81-265-4660-2

INTRODUCTION TO DATA SRUCTURES AND ALGORITHM
(OPEN ELECTIVE)
(Effective from the academic year 2018 -2019)

SEMESTER – VI

Course Code	**18CS652**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03

CREDITS –3

Course Learning Objectives: This course (18CS652) will enable students to:

- Identify different data structures in C programming language
- Appraise the use of data structures in problem solving
- Implement data structures using C programming language.

Module 1	**Contact Hours**
Introduction to C, constants, variables, data types, input output operations, operators and expressions, control statements, arrays, strings, built-in functions, user defined functions, structures, unions and pointers **Text Book 1: Chapter 1 and 2** **RBT: L1, L2**	08
Module 2	
Algorithms, Asymptotic notations, Introduction to data structures, Types of data structures, Arrays. **Text Book 1: Chapter 3 and 4** **RBT: L1, L2**	08
Module 3	
Linked lists, Stacks **Text Book 1: Chapter 5 and 6** **RBT: L1, L2**	08
Module 4	
Queues, Trees **Text Book 1: Chapter 7 and 8** **RBT: L1, L2**	08
Module 5	
Graphs, Sorting ,(selection, insertion, bubble, quick)and searching(Linear, Binary, Hash) **Text Book 1: Chapter 7 and 8** **RBT: L1, L2**	08

Course Outcomes: The student will be able to :

- Identify different data structures in C programming language
- Appraise the use of data structures in problem solving
- Implement data structures using C programming language.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Data structures using C , E Balagurusamy, McGraw Hill education (India) Pvt. Ltd, 2013.

Reference Books:

1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014.
2. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.

PROGRAMMING IN JAVA
(OPEN ELECTIVE)
(Effective from the academic year 2018 -2019)
SEMESTER – VI

Course Code	**18CS653**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03

CREDITS –3

Course Learning Objectives: This course (18CS653) will enable students to:

- Learn fundamental features of object oriented language and JAVA
- Set up Java JDK environment to create, debug and run simple Java programs.
- Learn object oriented concepts using programming examples.
- Study the concepts of importing of packages and exception handling mechanism.
- Discuss the String Handling examples with Object Oriented concepts

Module – 1	**Teaching Hours**
An Overview of Java: Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries, Data Types, Variables, and Arrays: Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, A Few Words About Strings **Text book 1: Ch 2, Ch 3** **RBT: L1, L2**	08
Module – 2	
Operators: Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses, Control Statements: Java's Selection Statements, Iteration Statements, Jump Statements. **Text book 1: Ch 4, Ch 5** **RBT: L1, L2**	08
Module – 3	
Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize( ) Method, A Stack Class, A Closer Look at Methods and Classes: Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion, Introducing Access Control, Understanding static, Introducing final, Arrays Revisited, Inheritance: Inheritance, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class. **Text book 1: Ch 6, Ch 7.1-7.9, Ch 8.** **RBT: L1, L2**	08
Module – 4	
Packages and Interfaces: Packages, Access Protection, Importing Packages, Interfaces, Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions.	08

Text book 1: Ch 9, Ch 10 **RBT: L1, L2**	
Module – 5	
Enumerations, Type Wrappers, I/O, Applets, and Other Topics: I/O Basics, Reading Console Input, Writing Console Output, The PrintWriter Class, Reading and Writing Files, Applet Fundamentals, The transient and volatile Modifiers, Using instanceof, strictfp, Native Methods, Using assert, Static Import, Invoking Overloaded Constructors Through this( ), String Handling: The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf( ), Changing the Case of Characters Within a String , Additional String Methods, StringBuffer, StringBuilder. **Text book 1: Ch 12.1,12.2, Ch 13, Ch 15** **RBT: L1, L2**	08
Course outcomes: The students should be able to:	
• Explain the object-oriented concepts and JAVA. • Develop computer programs to solve real world problems in Java. Develop simple GUI interfaces for a computer program to interact with users	
Question Paper Pattern:	
• The question paper will have ten questions. • Each full Question consisting of 20 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007. (Chapters 2, 3, 4, 5, 6,7, 8, 9,10, 12,13,15)	
Reference Books:	
1. Cay S Horstmann, "Core Java - Vol. 1 Fundamentals", Pearson Education, 10th Edition, 2016. 2. Raoul-Gabriel Urma, Mario Fusco, Alan Mycroft, "Java 8 in Action", Dreamtech Press/Manning Press, 1st Edition, 2014.	

<table>
<tr><td colspan="4">INTRODUCTION TO OPERATING SYSTEM
(OPEN ELECTIVE)
(Effective from the academic year 2018 -2019)
SEMESTER – VII</td></tr>
<tr><td>Course Code</td><td>18CS654</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Contact Hours/Week</td><td>3:0:0</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Contact Hours</td><td>40</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">CREDITS –3</td></tr>
<tr><td colspan="4">Course Learning Objectives: This course (18CS654) will enable students to:</td></tr>
<tr><td colspan="4">Explain the fundamentals of operating system
Comprehend multithreaded programming, process management, memory management and storage management.
Familier with various types of operating systems</td></tr>
<tr><td colspan="3">Module – 1</td><td>Teaching Hours</td></tr>
<tr><td colspan="3">Introduction: What OS do, Computer system organization, architecture, structure, Operations, Process, memory and storage management, Protection and security, Distributed systems, Special purpose systems, computing environments.
System Structure: OS Services, User OSI, System calls, Types of system calls, System programs, OS design and implementation, OS structure, Virtual machines, OS generation, system boot
Textbook1: Chapter 1, 2
RBT: L1, L2</td><td>08</td></tr>
<tr><td colspan="4">Module – 2</td></tr>
<tr><td colspan="3">Process Concept: Overview, Process scheduling, Operations on process, IPC, Examples in IPC, Communication in client-server systems.
Multithreaded Programming: Overview, Models, Libraries, Issues, OS Examples
Textbook1: Chapter 3,4
RBT: L1, L2</td><td>08</td></tr>
<tr><td colspan="4">Module – 3</td></tr>
<tr><td colspan="3">Process Scheduling: Basic concept, Scheduling criteria, Algorithm, multiple processor scheduling, thread scheduling, OS Examples, Algorithm Evaluation.
Synchronization: Background, the critical section problem, Petersons solution, Synchronization hardware, Semaphores, Classic problems of synchronization, Monitors, Synchronization examples, Atomic transactions
Textbook1: Chapter 5, 6
RBT: L1, L2</td><td>08</td></tr>
<tr><td colspan="4">Module – 4</td></tr>
<tr><td colspan="3">Deadlocks: System model, Deadlock characterization, Method of handling deadlock, Deadlock prevention, Avoidance, Detection, Recovery from deadlock
Memory management strategies: Background, swapping, contiguous memory allocation, paging, structure of page table, segmentation,
Textbook1: Chapter 7, 8
RBT: L1, L2</td><td>08</td></tr>
<tr><td colspan="4">Module – 5</td></tr>
<tr><td colspan="3">Virtual Memory management: Background, Demand paging, Copy-on-write, Page replacement, allocation of frames, Trashing, Memory mapped files, Allocating Kernel memory, Operating system examples</td><td>08</td></tr>
</table>

File system: File concept, Access methods, Directory structure, File system mounting, File sharing, protection **Textbook1: Chapter 9, 10** **RBT: L1, L2**	

Course outcomes: The students should be able to:

- Explain the fundamentals of operating system
- Comprehend process management, memory management and storage management.
- Familiar with various types of operating systems

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. A. Silberschatz, P B Galvin, G Gagne, Operating systems, 7th edition, John Wiley and sons,.

Reference Books:

1. William Stalling,"Operating Systems: Internals and Design Principles", Pearson Education, 1st Edition, 2018.
2. Andrew S Tanenbaum, Herbert BOS, "Modern Operating Systems", Pearson Education, 4th Edition, 2016

SYSTEM SOFTWARE LABORATORY
(Effective from the academic year 2018 -2019)
SEMESTER – VI

Course Code	**18CSL66**	**CIE Marks**	40
Number of Contact Hours/Week	0:2:2	**SEE Marks**	60
Total Number of Lab Contact Hours	36	**Exam Hours**	03

Credits – 2

Course Learning Objectives: This course (18CSL66) will enable students to:

- To make students familiar with Lexical Analysis and Syntax Analysis phases of Compiler Design and implement programs on these phases using LEX & YACC tools and/or C/C++/Java
- To enable students to learn different types of CPU scheduling algorithms used in operating system.
- To make students able to implement memory management - page replacement and deadlock handling algorithms

Descriptions (if any):

Exercises to be prepared with minimum three files (Where ever necessary):

1. Header file.
2. Implementation file.
3. Application file where main function will be present.

The idea behind using three files is to differentiate between the developer and user sides. In the developer side, all the three files could be made visible. For the user side only header file and application files could be made visible, which means that the object code of the implementation file could be given to the user along with the interface given in the header file, hiding the source file, if required. Avoid I/O operations (printf/scanf) and use ***data input file*** where ever it is possible.

Programs List:

Installation procedure of the required software must be demonstrated, carried out in groups and documented in the journal.

1.	
a.	Write a LEX program to recognize valid ***arithmetic expression.*** Identifiers in the expression could be only integers and operators could be + and *. Count the identifiers & operators present and print them separately.
b.	Write YACC program to evaluate ***arithmetic expression*** involving operators: +, -, *, and /
2.	Develop, Implement and Execute a program using YACC tool to recognize all strings ending with ***b*** preceded by ***n a's*** using the grammar a^n ***b*** (note: input ***n*** value)
3.	Design, develop and implement YACC/C program to construct ***Predictive / LL(1) Parsing Table*** for the grammar rules: ***A →aBa , B →bB | ε***. Use this table to parse the sentence: ***abba$***
4.	Design, develop and implement YACC/C program to demonstrate ***Shift Reduce Parsing*** technique for the grammar rules: ***E →E+T | T, T →T*F | F, F →(E) | id*** and parse the sentence: ***id + id * id***.
5.	Design, develop and implement a C/Java program to generate the machine code using ***Triples*** for the statement ***A = -B * (C +D)*** whose intermediate code in three-address form: ***T1 = -B*** ***T2 = C + D*** ***T3 = T1 + T2*** ***A = T3***

6.	
a.	Write a LEX program to eliminate ***comment lines*** in a ***C*** program and copy the resulting program into a separate file.
b.	Write YACC program to recognize valid ***identifier, operators and keywords*** in the given text (*C program*) file.
7.	Design, develop and implement a C/C++/Java program to simulate the working of Shortest remaining time and Round Robin (RR) scheduling algorithms. Experiment with different quantum sizes for RR algorithm.
8.	Design, develop and implement a C/C++/Java program to implement Banker's algorithm. Assume suitable input required to demonstrate the results
9.	Design, develop and implement a C/C++/Java program to implement page replacement algorithms LRU and FIFO. Assume suitable input required to demonstrate the results.

Laboratory Outcomes: The student should be able to:

- Implement and demonstrate Lexer's and Parser's
- Evaluate different algorithms required for management, scheduling, allocation and communication used in operating system.

Conduct of Practical Examination:

- Experiment distribution
  - For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
  - For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.
- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution *(Courseed to change in accoradance with university regulations)*
  - m) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
  - n) For laboratories having PART A and PART B
    - i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
    - ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

COMPUTER GRAPHICS LABORATORY WITH MINI PROJECT
(Effective from the academic year 2018 -2019)
SEMESTER – VI

Course Code	**18CSL67**	**CIE Marks**	40
Number of Contact Hours/Week	0:2:2	**SEE Marks**	60
Total Number of Lab Contact Hours	36	**Exam Hours**	03

Credits – 2

Course Learning Objectives: This course (18CSL67) will enable students to:

- Demonstrate simple algorithms using OpenGL Graphics Primitives and attributes.
- Implementation of line drawing and clipping algorithms using OpenGL functions
- Design and implementation of algorithms Geometric transformations on both 2D and 3D objects.

Descriptions (if any): --

Installation procedure of the required software must be demonstrated, carried out in groups and documented in the journal.

Programs List:

PART A

Design, develop, and implement the following programs using OpenGL API

1.	Implement Brenham's line drawing algorithm for all types of slope. Refer:Text-1: Chapter 3.5 Refer:Text-2: Chapter 8
2.	Create and rotate a triangle about the origin and a fixed point. **Refer:Text-1: Chapter 5-4**
3.	Draw a colour cube and spin it using OpenGL transformation matrices. **Refer:Text-2: Modelling a Coloured Cube**
4.	Draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing. **Refer:Text-2: Topic: Positioning of Camera**
5.	Clip a lines using Cohen-Sutherland algorithm **Refer:Text-1: Chapter 6.7** **Refer:Text-2: Chapter 8**
6.	To draw a simple shaded scene consisting of a tea pot on a table. Define suitably the position and properties of the light source along with the properties of the surfaces of the solid object used in the scene. **Refer:Text-2: Topic: Lighting and Shading**
7.	Design, develop and implement recursively subdivide a tetrahedron to form 3D sierpinski gasket. The number of recursive steps is to be specified by the user. **Refer: Text-2: Topic:** sierpinski gasket.
8.	Develop a menu driven program to animate a flag using Bezier Curve algorithm **Refer: Text-1: Chapter** 8-10
9.	Develop a menu driven program to fill the polygon using scan line algorithm

PART B MINI PROJECT

Student should develop mini project on the topics mentioned below or similar applications using Open GL API. Consider all types of attributes like color, thickness, styles, font, background, speed etc., while doing mini project.

(**During the practical exam: the students should demonstrate and answer Viva-Voce**)

Sample Topics:

Simulation of concepts of OS, Data structures, algorithms etc.

Laboratory Outcomes: The student should be able to:

- Apply the concepts of computer graphics

• Implement computer graphics applications using OpenGL • Animate real world problems using OpenGL
Conduct of Practical Examination:

• Experiment distribution
    o For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
    o For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.
• Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
• Marks Distribution *(Courseed to change in accoradance with university regulations)*
    o) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
    p) For laboratories having PART A and PART B
        i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
        ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

MOBILE APPLICATION DEVELOPMENT
(Effective from the academic year 2018 -2019)
SEMESTER – VI

Course Code	**18CSMP68**	**IA Marks**	40
Number of Contact Hours/Week	0:0:2	**Exam Marks**	60
Total Number of Contact Hours	3 Hours/Week	**Exam Hours**	03

CREDITS – 02

Laboratory Objectives: Thislaboratory (18CSMP68) will enable students to

- Learn and acquire the art of Android Programming.
- ConfigureAndroid studio to run the applications.
- Understand and implement Android's User interface functions.
- Create, modify and query on SQlite database.
- Inspect different methods of sharing data using services.

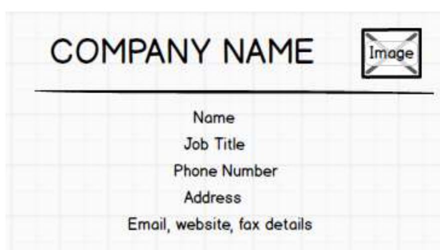
Descriptions (if any):

1. The installation procedure of the Android Studio/Java software must be demonstrated and carried out in groups.
2. Students should use the latest version of Android Studio/Java/ Kotlin to execute these programs. Diagrams given are for representational purposes only, students are expected to improvise on them.
3. **Part B programs should be developed as an application and are to be demonstrated as a mini project in a group by adding extra features or the students can also develop their application and demonstrate it as a mini-project. (Projects/programs are not limited to the list given in Part B).**

Programs List:

PART – A

1	Create an application to design aVisiting Card. The Visiting card should havea companylogoatthe top right corner. The company name should be displayed in Capital letters, aligned to the center. Information like the name of the employee, job title, phone number, address, email, fax and the website address isto be displayed. Insert a horizontal line between the job title and the phone number.
2	Develop an Android application usingcontrols like Button, TextView, EditText for designing a calculatorhaving basic functionality like Addition, Subtraction, Multiplication,andDivision.



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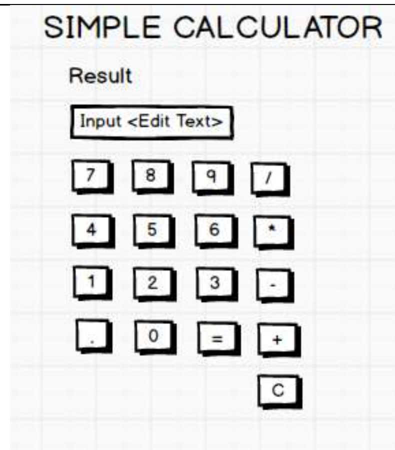

</td>
</tr>
<tr>
<td>3</td>
<td>

Create a SIGN Up activity with Username and Password. Validation of password should happen based on the following rules:

- Password should contain uppercase and lowercase letters.
- Password should contain letters and numbers.
- Password should contain special characters.
- Minimum length of the password (the default value is 8).

On successful **SIGN UP** proceed to the next Login activity. Here the user should **SIGN IN** using the Username and Password created during signup activity. If the Username and Password are matched then navigate to the next activity whichdisplays a message saying “Successful Login” or else display a toast message saying “Login Failed”.The user is given only two attempts and after thatdisplay a toast message saying “Failed Login Attempts” and disable the SIGN IN button. Use Bundle to transfer information from one activity to another.

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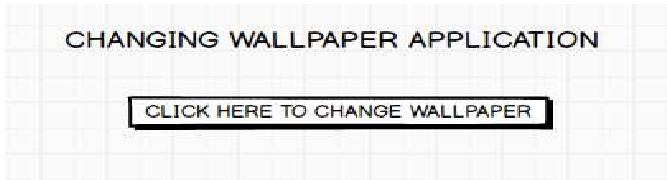
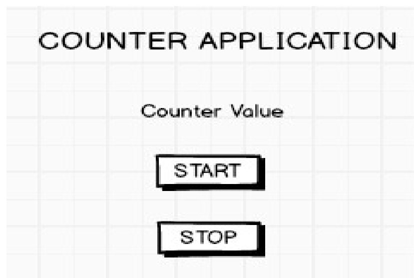
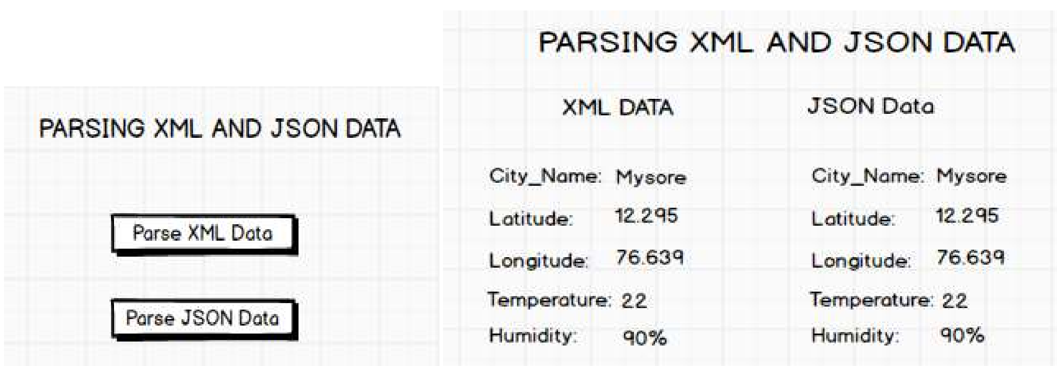
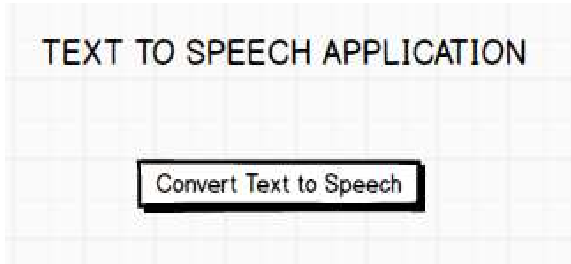
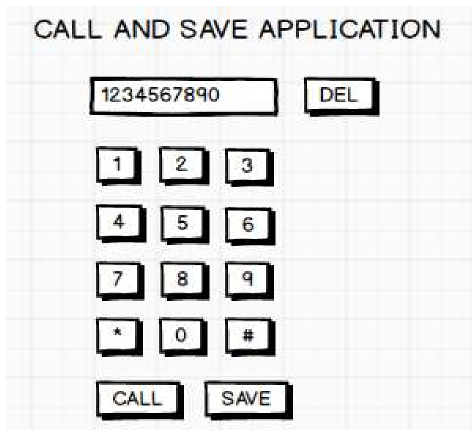
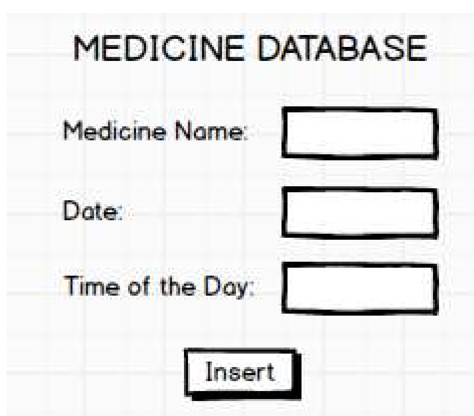
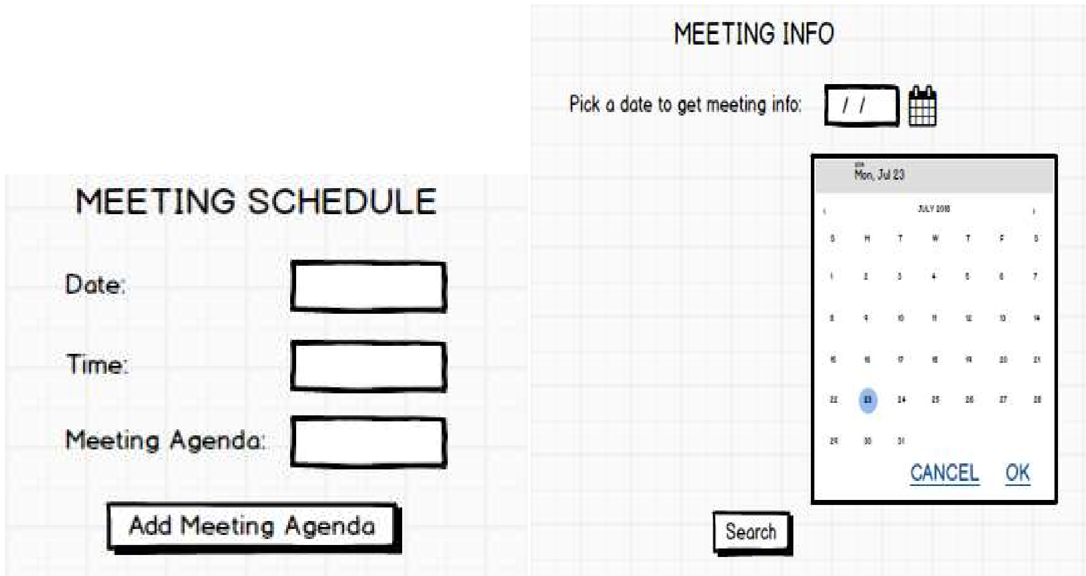
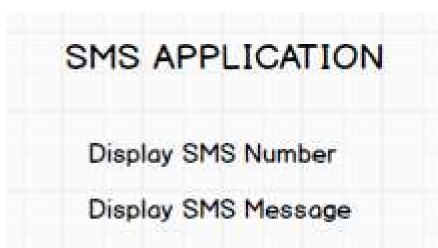
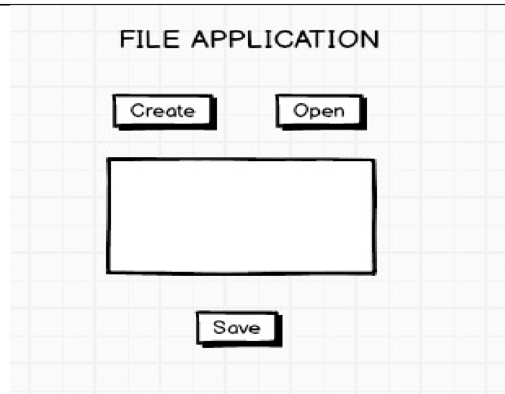
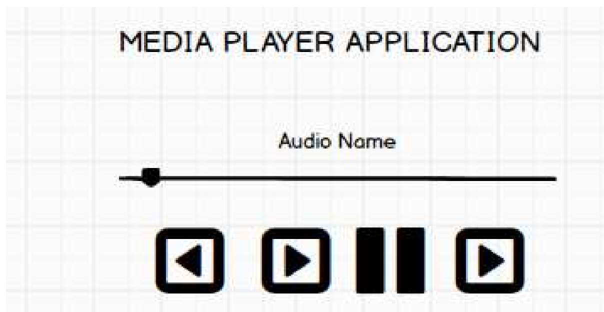
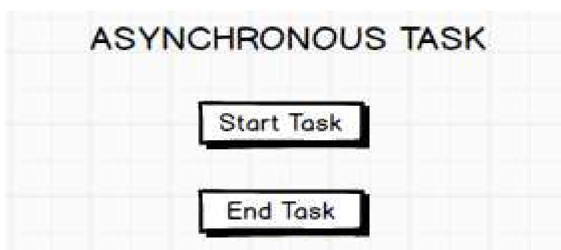
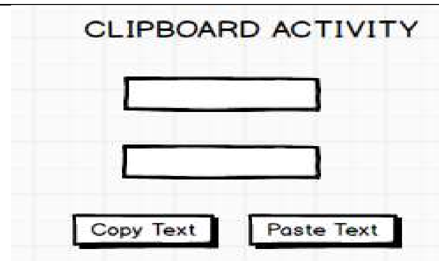
</table>

4	Develop an application to set an image as wallpaper. On click of a button, the wallpaper image should start to change randomly every 30 seconds. 
5	Write a program to create an activity with two buttons START and STOP. On pressingoftheSTART button, the activity must start the counter by displaying the numbers from One and the counter must keep on counting until the STOP button is pressed. Display the counter value in a TextViewcontrol. 
6	Create two files of XML and JSON type with values for City_Name, Latitude, Longitude, Temperature,andHumidity. Develop an application to create an activity with two buttons to parse the XML and JSON files which when clicked should display the data in their respective layouts side by side. 

7	Develop a simple application withoneEditTextso that the user can write some text in it. Create a button called “Convert Text to Speech” that converts the user input text into voice. 
8	Create an activity like a phone dialer withCALLand SAVE buttons. On pressing the CALL button, it must call the phone number and on pressing the SAVE button it must save the number to the phone contacts. 
PART - B	
1	Write a program to enter Medicine Name, Date and Time of the Day as input from the user and store it in the SQLite database. Input for Time of the Day should be either Morning or Afternoon or Eveningor Night. Trigger an alarm based on the Date and Time of the Day and display the Medicine Name. 

<table>
<tr><td>2</td><td>Develop a content provider application with an activity called “Meeting Schedule” which takes Date, Time and Meeting Agenda as input from the user and store this information into the SQLite database. Create another application with an activity called “Meeting Info” having DatePicker control, which on the selection of a date should display the Meeting Agenda information for that particular date, else it should display a toast message saying “No Meeting on this Date”.

</td></tr>
<tr><td>3</td><td>Create an application to receive an incoming SMS which is notified to the user. On clicking this SMS notification, the message content and the number should be displayed on the screen. Use appropriate emulator control to send the SMS message to your application.

</td></tr>
<tr><td>4</td><td>Write a program to create an activity having a Text box, and also Save, Open and Create buttons. The user has to write some text in the Text box. On pressing the Create button the text should be saved as a text file in MkSDcard. On subsequent changes to the text, the Save button should be pressed to store the latest content to the same file. On pressing the Open button, it should display the contents from the previously stored files in the Text box. If the user tries to save the contents in the Textbox to a file without creating it, then a toast message has to be displayed saying “First Create a File”.</td></tr>
</table>

	
5	Create an application to demonstrate a basic media playerthat allows the user to Forward, Backward, Play and Pause an audio. Also, make use of the indicator in the seek bar to move the audio forward or backward as required. 
6	Develop an application to demonstrate the use of Asynchronous tasks in android. The asynchronous task should implement the functionality of a simple moving banner. On pressing the **Start Task** button, the banner message should scrollfrom right to left. On pressing the **Stop Task** button, the banner message should stop.Let the banner message be “Demonstration of Asynchronous Task”. 
7	Develop an application that makes use of the clipboard framework for copying and pasting of the text. The activity consists of two EditText controls and two Buttons to trigger the copy and paste functionality.



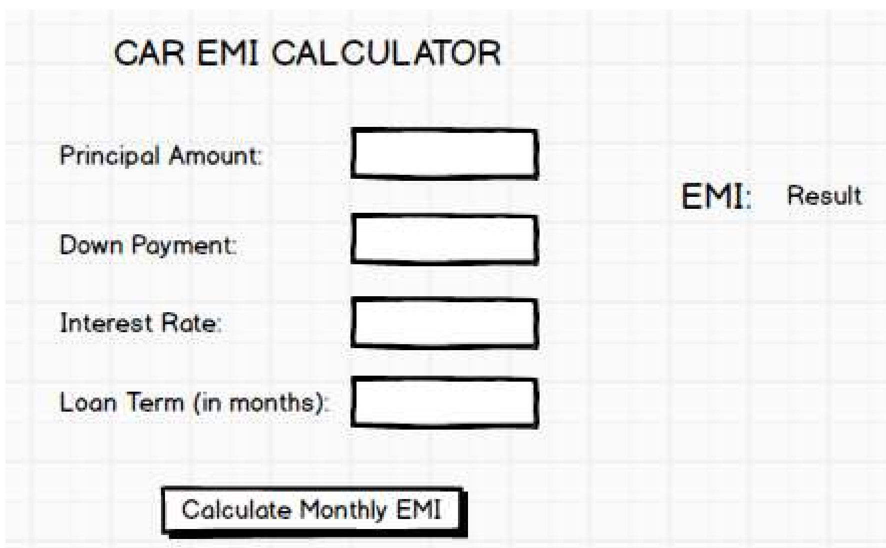
8 Create an AIDL service that calculates Car Loan EMI. The formula to calculate EMI is

$$\mathbf{E = P * (r(1+r)^n)/((1+r)^n-1)}$$

where

E = The EMI payable on the car loan amount
P = The Car loan Principal Amount
r = The interest rate value computed on a monthly basis
n = The loan tenure in the form of months

The down payment amount has to be deducted from the principal amount paid towards buying the Car. Develop an application that makes use of this AIDL service to calculate the EMI. This application should have four EditText to read the PrincipalAmount, Down Payment, Interest Rate, Loan Term (in months) and a button named as “Calculate Monthly EMI”. On click of this button, the result should be shown in a TextView. Also, calculate the EMI by varying the Loan Term and Interest Rate values.



Laboratory Outcomes: After studying theselaboratory programs, students will be able to

- Create, test and debug Android application by setting up Android development environment.
- Implement adaptive, responsive user interfaces that work across a wide range of devices.
- Infer long running tasks and background work in Android applications.
- Demonstrate methods in storing, sharing and retrieving data in Android applications.

- Infer the role of permissions and security for Android applications.

Procedure to Conduct Practical Examination

- Experiment distribution
  - For laboratories having only one part: Students are allowed to pick oneexperiment from the lot with equal opportunity.
  - For laboratories having PART A and PART B: Students are allowed to pick oneexperiment from PART A and one experiment from PART B, with equalopportunity.

- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.

- Marks Distribution (Courseed to change in accordance with university regulations)
  - For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15= 100 Marks
  - For laboratories having PART A and PART B
    i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks

    ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

Text Books:

1. Google Developer Training, **"Android Developer Fundamentals Course – Concept Reference",** Google Developer Training Team, 2017. https://www.gitbook.com/book/google-developer-training/android-developer-fundamentals-course-concepts/details
   (Download pdf file from the above link)

Reference Books:

1. Erik Hellman, **"Android Programming – Pushing the Limits",** 1st Edition, Wiley India Pvt Ltd, 2014. ISBN-13: 978-8126547197
2. Dawn Griffiths and David Griffiths, **"Head First Android Development",** 1st Edition, O'Reilly SPD Publishers, 2015. ISBN-13: 978-9352131341
3. Bill Phillips, Chris Stewart and Kristin Marsicano, **"Android Programming: The Big Nerd Ranch Guide",** 3rd Edition, Big Nerd Ranch Guides, 2017. ISBN-13: 978-0134706054

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (Effective from the academic year 2018 -2019) SEMESTER – VII			
Course Code	**18CS71**	**CIE Marks**	40
Number of Contact Hours/Week	4:0:0	**SEE Marks**	60
Total Number of Contact Hours	50	**Exam Hours**	03
CREDITS –4			

Course Learning Objectives: This course (18CS71) will enable students to:

- Explain Artificial Intelligence and Machine Learning
- Illustrate AI and ML algorithm and their use in appropriate applications

Module 1	Contact Hours
What is artificial intelligence?, Problems, problem spaces and search, Heuristic search techniques **Texbook 1: Chapter 1, 2 and 3** **RBT: L1, L2**	10
Module 2	
Knowledge representation issues, Predicate logic, Representaiton knowledge using rules. Concpet Learning: Concept learning task, Concpet learning as search, Find-S algorithm, Candidate Elimination Algorithm, Inductive bias of Candidate Elimination Algorithm. **Texbook 1: Chapter 4, 5 and 6** **Texbook2: Chapter 2 (2.1-2.5, 2.7)** **RBT: L1, L2, L3**	10
Module 3	
Decision Tree Learning: Introduction, Decision tree representation, Appropriate problems, ID3 algorith. Aritificil Nueral Network: Introduction, NN representation, Appropriate problems, Perceptrons, Backpropagation algorithm. **Texbook2: Chapter 3 (3.1-3.4), Chapter 4 (4.1-4.5)** **RBT: L1, L2, L3**	10
Module 4	
Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting, MDL principle, Bates optimal classifier, Gibbs algorithm, Navie Bayes classifier, BBN, EM Algorithm **Texbook2: Chapter 6** **RBT: L1, L2, L3**	10
Module 5	
Instance-Base Learning: Introduction, k-Nearest Neighbour Learning, Locally weighted regression, Radial basis function, Case-Based reasoning. Reinforcement Learning: Introduction, The learning task, Q-Learning. **Texbook 1: Chapter 8 (8.1-8.5), Chapter 13 (13.1 – 13.3)** **RBT: L1, L2, L3**	10

Course Outcomes: The student will be able to :

- Appaise the theory of Artificial intelligence and Machine Learning.
- Illustrate the working of AI and ML Algorithms.
- Demonstrate the applications of AI and ML.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks

- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Tom M Mitchell,**"Machine Lerning",**1st Edition, McGraw Hill Education, 2017.
2. Elaine Rich, Kevin K and S B Nair, **"Artificial Inteligence",** 3rd Edition, McGraw Hill Education, 2017.

Reference Books:

1. Saroj Kaushik, Artificial Intelligence, Cengage learning
2. Stuart Rusell, Peter Norving , Artificial Intelligence: A Modern Approach, Pearson Education 2nd Edition
3. AurÈlienGÈron,"Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, Shroff/O'Reilly Media, 2017.
4. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
5. Ethem Alpaydın, Introduction to machine learning, second edition, MIT press
6. Srinvivasa K G and Shreedhar, " Artificial Intelligence and Machine Learning", Cengage

<table>
<tr><td colspan="4">BIG DATA AND ANALYTICS
(Effective from the academic year 2018 -2019)
SEMESTER – VII</td></tr>
<tr><td>Course Code</td><td>18CS72</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Contact Hours/Week</td><td>4:0:0</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Contact Hours</td><td>50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">CREDITS –4</td></tr>
<tr><td colspan="4">Course Learning Objectives: This course (18CS72) will enable students to:</td></tr>
<tr><td colspan="4">Understand fundamentals of Big Data analytics
Explore the Hadoop framework and Hadoop Distributed File system
Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data
Employ MapReduce programming model to process the big data
Understand various machine learning algorithms for Big Data Analytics, Web Mining and Social Network Analysis.</td></tr>
<tr><td colspan="3">Module 1</td><td>Contact Hours</td></tr>
<tr><td colspan="3">Introduction to Big Data Analytics: Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis, Big Data Analytics Applications and Case Studies.
Text book 1: Chapter 1: 1.2 -1.7
RBT: L1, L2, L3</td><td>10</td></tr>
<tr><td colspan="3">Module 2</td><td></td></tr>
<tr><td colspan="3">Introduction to Hadoop (T1): Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools.
Hadoop Distributed File System Basics (T2): HDFS Design Features, Components, HDFS User Commands.
Essential Hadoop Tools (T2): Using Apache Pig, Hive, Sqoop, Flume, Oozie, HBase.
Text book 1: Chapter 2 :2.1-2.6
Text Book 2: Chapter 3
Text Book 2: Chapter 7 (except walk throughs)
RBT: L1, L2, L3</td><td>10</td></tr>
<tr><td colspan="3">Module 3</td><td></td></tr>
<tr><td colspan="3">NoSQL Big Data Management, MongoDB and Cassandra: Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB, Databases, Cassandra Databases.
Text book 1: Chapter 3: 3.1-3.7
RBT: L1, L2, L3</td><td>10</td></tr>
<tr><td colspan="3">Module 4</td><td></td></tr>
<tr><td colspan="3">MapReduce, Hive and Pig: Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms, Hive, HiveQL, Pig.
Text book 1: Chapter 4: 4.1-4.6
RBT: L1, L2, L3</td><td>10</td></tr>
</table>

<table>
<tr><td>Module 5</td><td></td></tr>
<tr><td>Machine Learning Algorithms for Big Data Analytics: Introduction, Estimating the relationships, Outliers, Variances, Probability Distributions, and Correlations,
Regression analysis, Finding Similar Items, Similarity of Sets and Collaborative Filtering, Frequent Itemsets and Association Rule Mining.
Text, Web Content, Link, and Social Network Analytics: Introduction, Text mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and analyzing a Web Graph, Social Network as Graphs and Social Network Analytics:
Text book 1: Chapter 6: 6.1 to 6.5
Text book 1: Chapter 9: 9.1 to 9.5</td><td>10</td></tr>
<tr><td colspan="2">Course Outcomes: The student will be able to:</td></tr>
<tr><td colspan="2">• Understand fundamentals of Big Data analytics.
• Investigate Hadoop framework and Hadoop Distributed File system.
• Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data.
• Demonstrate the MapReduce programming model to process the big data along with Hadoop tools.
• Use Machine Learning algorithms for real world big data.
• Analyze web contents and Social Networks to provide analytics with relevant visualization tools.</td></tr>
<tr><td colspan="2">Question Paper Pattern:</td></tr>
<tr><td colspan="2">• The question paper will have ten questions.
• Each full Question consisting of 20 marks
• There will be 2 full questions (with a maximum of four sub questions) from each module.
• Each full question will have sub questions covering all the topics under a module.
• The students will have to answer 5 full questions, selecting one full question from each module.</td></tr>
<tr><td colspan="2">Textbooks:</td></tr>
<tr><td colspan="2">1. Raj Kamal and Preeti Saxena, “Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning”, McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966
2. Douglas Eadline, "Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem", 1stEdition, Pearson Education, 2016. ISBN-13: 978-9332570351</td></tr>
<tr><td colspan="2">Reference Books:</td></tr>
<tr><td colspan="2">1. Tom White, “Hadoop: The Definitive Guide”, 4th Edition, O’Reilly Media, 2015.ISBN-13: 978-9352130672
2. Boris Lublinsky, Kevin T Smith, Alexey Yakubovich, "Professional Hadoop Solutions", 1stEdition, Wrox Press, 2014ISBN-13: 978-8126551071
3. Eric Sammer, "Hadoop Operations: A Guide for Developers and Administrators",1stEdition, O'Reilly Media, 2012.ISBN-13: 978-9350239261
4. Arshdeep Bahga, Vijay Madisetti, "Big Data Analytics: A Hands-On Approach", 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577</td></tr>
</table>

<table>
<tr><td colspan="4" align="center">SOFTWARE ARCHITECTURE AND DESIGN PATTERNS
(Effective from the academic year 2018 -2019)
SEMESTER – VII</td></tr>
<tr><td>Course Code</td><td>18CS731</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Contact Hours/Week</td><td>3:0:0</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Contact Hours</td><td>40</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4" align="center">CREDITS –3</td></tr>
<tr><td colspan="4">Course Learning Objectives: This course (18CS731) will enable students to:</td></tr>
<tr><td colspan="4">• Learn How to add functionality to designs while minimizing complexity.
• What code qualities are required to maintain to keep code flexible?
• To Understand the common design patterns.
• To explore the appropriate patterns for design problems</td></tr>
<tr><td colspan="3">Module 1</td><td>Contact Hours</td></tr>
<tr><td colspan="3">Introduction: what is a design pattern? describing design patterns, the catalog of design pattern, organizing the catalog, how design patterns solve design problems, how to select a design pattern, how to use a design pattern. A Notation for Describing Object-Oriented Systems
Textbook 1: Chapter 1 and 2.7
Analysis a System: overview of the analysis phase, stage 1: gathering the requirements functional requirements specification, defining conceptual classes and relationships, using the knowledge of the domain. Design and Implementation, discussions and further reading.
Textbook 1: Chapter 6
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="3">Module 2</td><td></td></tr>
<tr><td colspan="3">Design Pattern Catalog: Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy.
Textbook 2: chapter 4
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="3">Module 3</td><td></td></tr>
<tr><td colspan="3">BehavioralPatterns: Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, State, Template Method
Textbook 2: chapter 5
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="3">Module 4</td><td></td></tr>
<tr><td colspan="3">Interactive systems and the MVC architecture: Introduction, The MVC architectural pattern, analyzing a simple drawing program, designing the system, designing of the subsystems, getting into implementation, implementing undo operation, drawing incompleteitems, adding a new feature, pattern-based solutions.
Textbook 1: Chapter 11
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="3">Module 5</td><td></td></tr>
<tr><td colspan="3">Designing with Distributed Objects: Client server system, java remote method invocation, implementing an object-oriented system on the web (discussions and further reading) a note on input and output, selection statements, loops arrays.
Textbook 1: Chapter 12
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="4">Course Outcomes: The student will be able to :</td></tr>
<tr><td colspan="4">• Design and implement codes with higher performance and lower complexity
• Be aware of code qualities needed to keep code flexible</td></tr>
</table>

- Experience core design principles and be able to assess the quality of a design with respect to these principles.
- Capable of applying these principles in the design of object oriented systems.
- Demonstrate an understanding of a range of design patterns. Be capable of comprehending a design presented using this vocabulary.
- Be able to select and apply suitable patterns in specific contexts

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Brahma Dathan, Sarnath Rammath, Object-oriented analysis, design and implementation, Universities Press,2013
2. Erich Gamma, Richard Helan, Ralph Johman, John Vlissides , Design Patterns, Pearson Publication,2013.

Reference Books:

1. Frank Bachmann, RegineMeunier, Hans Rohnert “Pattern Oriented Software Architecture” –Volume 1, 1996.
2. William J Brown et al., "Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998.

HIGH PERFORMANCE COMPUTING (Effective from the academic year 2018 -2019) SEMESTER – VII			
Course Code	**18CS732**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03
CREDITS –3			
Course Learning Objectives: This course (18CS732) will enable students to:			
• Introduce students the design, analysis, and implementation, of high performance computational science and engineering applications. • Illustrate on advanced computer architectures, parallel algorithms, parallel languages, and performance-oriented computing.			

Module – 1	**Contact Hours**
Introduction to Parallel Computing: Motivating Parallelism, Scope of Parallel Computing, **Parallel Programming Platforms:** Implicit Parallelism: Trends in Microprocessor Architectures, Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact of Process-Processor Mapping and Mapping Techniques. **T1: Ch: 1.1, 1.2, 2.1 – 2.7** **RBT: L1, L2**	08
Module – 2	
Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models **Basic Communication Operations:** One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, All-to-All Personalized Communication, Circular Shift, Improving the Speed of Some Communication Operations **T1: Ch 3, 4** **RBT: L1, L2**	08
Module – 3	
Analytical Modeling of Parallel Programs: Sources of Overhead in Parallel Programs, Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of Parallel Systems. Minimum Execution Time and Minimum Cost-Optimal Execution Time, Asymptotic Analysis of Parallel Programs Section 5.7. Other Scalability Metrics, Programming Using the Message-Passing Paradigm: Principles of Message-Passing Programming, The Building Blocks: Send and Receive Operations, MPI: the Message Passing Interface, Topologies and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations, Groups and Communicators **T1: Ch 5, 6** **RBT: L1, L2, L3**	08
Module – 4	
Programming Shared Address Space Platforms: Thread Basics, Why Threads?, The POSIX Thread API, Thread Basics: Creation and Termination, Synchronization Primitives in Pthreads, Controlling Thread and Synchronization Attributes, Thread Cancellation,	08

Composite Synchronization Constructs, Tips for Designing Asynchronous Programs, OpenMP: a Standard for Directive Based Parallel Programming Dense Matrix Algorithms: Matrix-Vector Multiplication, Matrix-Matrix Multiplication, Solving a System of Linear Equations Sorting: Issues in Sorting on Parallel Computers, Sorting Networks, Bubble Sort and its Variants, Quicksort, Bucket and Sample Sort. **T1: Ch 7, 8 9** **RBT: L1, L2**	
Module – 5	
Graph Algorithms: Definitions and Representation, Minimum Spanning Tree: Prim's Algorithm, Single-Source Shortest Paths: Dijkstra's Algorithm, All-Pairs Shortest Paths, Transitive Closure, Connected Components, Algorithms for Sparse Graphs, Search Algorithms for Discrete Optimization Problems: Definitions and Examples, Sequential Search Algorithms, Search Overhead Factor, Parallel Depth-First Search, Parallel Best-First Search, Speedup, Anomalies in Parallel Search Algorithms **T1: Ch10, 11** **RBT: L1, L2**	08

Course outcomes: The students should be able to:

- Illustrate the key factors affecting performance of CSE applications
- Illusrate mapping of applications to high-performance computing systems
- Apply hardware/software co-design for achieving performance on real-world applications

Question paper pattern:

- The question paper will have ten questions.
- There will be 2 questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Introduction to Parallel Computing, AnanthGrama, Anshul Gupta, George Karypis, and Vipin Kumar, 2nd edition, Addison-Welsey, 2003.

Reference Books:

1. Grama, A. Gupta, G. Karypis, V. Kumar, An Introduction to Parallel Computing, Design and Analysis of Algorithms: 2/e, Addison-Wesley, 2003.
2. G.E. Karniadakis, R.M. Kirby II, Parallel Scientific Computing in C++ and MPI: A Seamless Approach to Parallel Algorithms and their Implementation, Cambridge University Press,2003.
3. Wilkinson and M. Allen, Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers, 2/E, Prentice Hall, 2005.
4. M.J. Quinn, Parallel Programming in C with MPI and OpenMP, McGraw-Hill, 2004.
5. G.S. Almasi and A. Gottlieb, Highly Parallel Computing, 2/E, Addison-Wesley, 1994.
6. David Culler Jaswinder Pal Singh,"Parallel Computer Architecture: A hardware/Software Approach", Morgan Kaufmann, 1999.
7. Kai Hwang, "Scalable Parallel Computing", McGraw Hill 1998.

<table>
<tr><td colspan="4">ADVANCED COMPUTER ARCHITECTURES
(Effective from the academic year 2018 -2019)
SEMESTER – VIII</td></tr>
<tr><td>Course Code</td><td>18CS733</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Contact Hours/Week</td><td>3:0:0</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Contact Hours</td><td>40</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">CREDITS –3</td></tr>
<tr><td colspan="4">Course Learning Objectives: This course (18CS733) will enable students to:</td></tr>
<tr><td colspan="4">Describe computer architecture.
Measure the performance of architectures in terms of right parameters.
Summarize parallel architecture and the software used for them</td></tr>
</table>

<table>
<tr><td>Module 1</td><td>Contact Hours</td></tr>
<tr><td>Theory of Parallelism: Parallel Computer Models, The State of Computing, Multiprocessors and Multicomputer, Multivector and SIMD Computers, PRAM and VLSI Models, Program and Network Properties, Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms, System Interconnect Architectures, Principles of Scalable Performance, Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws. For all Algorithm or mechanism any one example is sufficient.
Chapter 1 (1.1to 1.4), Chapter 2(2.1 to 2.4) Chapter 3 (3.1 to 3.3)
RBT: L1, L2</td><td>08</td></tr>
<tr><td>Module 2</td><td></td></tr>
<tr><td>Hardware Technologies 1: Processors and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology. For all Algorithms or mechanisms any one example is sufficient.
Chapter 4 (4.1 to 4.4)
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td>Module 3</td><td></td></tr>
<tr><td>Hardware Technologies 2: Bus Systems, Cache Memory Organizations, Shared Memory Organizations, Sequential and Weak Consistency Models, Pipelining and Superscalar Techniques, Linear Pipeline Processors, Nonlinear Pipeline Processors. For all Algorithms or mechanisms any one example is sufficient.
Chapter 5 (5.1 to 5.4) Chapter 6 (6.1 to 6.2)
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td>Module 4</td><td></td></tr>
<tr><td>Parallel and Scalable Architectures: Multiprocessors and Multicomputers, Multiprocessor System Interconnects, Cache Coherence and Synchronization Mechanisms, Message-Passing Mechanisms, Multivector and SIMD Computers, Vector Processing Principles, Multivector Multiprocessors, Compound Vector Processing, Scalable, Multithreaded, and Dataflow Architectures, Latency-Hiding Techniques, Principles of Multithreading, Fine-Grain Multicomputers. For all Algorithms or mechanisms any one example is sufficient.
Chapter 7 (7.1,7.2 and 7.4) Chapter 8(8.1 to 8.3) Chapter 9(9.1 to 9.3)
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td>Module 5</td><td></td></tr>
<tr><td>Software for parallel programming: Parallel Models, Languages, and Compilers ,Parallel Programming Models, Parallel Languages and Compilers, Dependence Analysis of Data Arrays. Instruction and System Level Parallelism, Instruction Level Parallelism, Computer Architecture, Contents, Basic Design Issues, Problem Definition, Model of a Typical</td><td>08</td></tr>
</table>

Processor, Compiler-detected Instruction Level Parallelism ,Operand Forwarding ,Reorder Buffer, Register Renaming ,Tomasulo's Algorithm. For all Algorithms or mechanisms any one example is sufficient. **Chapter 10(10.1 to 10.3) Chapter 12(12.1 to 12.9)** **RBT: L1, L2, L3**	

Course Outcomes: The student will be able to :

- Explain the concepts of parallel computing and hardware technologies
- Compare and contrast the parallel architectures
- Illustrate parallel programming concepts

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Kai Hwang and Naresh Jotwani, Advanced Computer Architecture (SIE): Parallelism, Scalability, Programmability, McGraw Hill Education 3/e. 2015

Reference Books:

1. John L. Hennessy and David A. Patterson, Computer Architecture: A quantitative approach, 5th edition, Morgan Kaufmann Elseveir, 2013

USER INTERFACE DESIGN
(Effective from the academic year 2018 -2019)
SEMESTER – VII

Course Code	**18CS734**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03

CREDITS –3

Course Learning Objectives: This course (18CS734) will enable students to:

- To study the concept of menus, windows, interfaces
- To study about business functions
- To study the characteristics and components of windows andthe various controls for the windows.
- To study about various problems in windows design with color, text, graphics a
- nd To study the testing methods

Module 1	**Contact Hours**
The User Interface-Introduction, Overview, The importance of user interface – Defining the user interface, The importance of Good design, Characteristics of graphical and web user interfaces, Principles of user interface design **Textbook 1: Ch. 1,2** **RBT: L1, L2**	08
Module 2	
The User Interface Design process- Obstacles, Usability, Human characteristics in Design, Human Interaction speeds, Business functions-Business definition and requirement analysis, Basic business functions, Design standards. **Textbook 1: Part-2** **RBT: L1, L2**	08
Module 3	
System menus and navigation schemes- Structures of menus, Functions of menus, Contents of menus, Formatting of menus, Phrasing the menu**,** Selecting menu choices, Navigating menus, Kinds of graphical menus. **Textbook 1: Part-2** **RBT: L1, L2**	08
Module 4	
Windows **-** Characteristics, Components of window, Window presentation styles, Types of window, Window management, Organizing window functions, Window operations, Web systems, Characteristics of device based controls. **Textbook 1: Part-2** **RBT: L1, L2**	08
Module 5	
Screen based controls- Operable control, Text control, Selection control, Custom control, Presentation control, Windows Tests-prototypes, kinds of tests. **Textbook 1: Part-2** **RBT: L1, L2**	08

Course Outcomes: The student will be able to :

- Design the User Interface, design, menu creation, windows creation and connection between menus and windows

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks

- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Wilbert O. Galitz, “The Essential Guide to User Interface Design”, John Wiley & Sons, Second Edition 2002.

Reference Books:

1. Ben Sheiderman, “Design the User Interface”, Pearson Education, 1998.
2. Alan Cooper, ”The Essential of User Interface Design”, Wiley- Dream Tech Ltd.,2002

<table>
<tr><td colspan="5">DIGITAL IMAGE PROCESSING
(Effective from the academic year 2018 -2019)
SEMESTER – VII</td></tr>
<tr><td>Course Code</td><td>18CS741</td><td colspan="2">CIE Marks</td><td>40</td></tr>
<tr><td>Number of Contact Hours/Week</td><td>3:0:0</td><td colspan="2">SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Contact Hours</td><td>40</td><td colspan="2">Exam Hours</td><td>03</td></tr>
<tr><td colspan="5">CREDITS –3</td></tr>
<tr><td colspan="5">Course Learning Objectives: This course (18CS741) will enable students to:</td></tr>
<tr><td colspan="5">• Define the fundamental concepts in image processing
• Evaluate techniques followed in image enhancements
• Illustrate image segmentation and compression algorithms</td></tr>
<tr><td colspan="4">Module 1</td><td>Contact Hours</td></tr>
<tr><td colspan="4">Introduction Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure), Some Basic Relationships Between Pixels- Neighbors and Connectivity of pixels in image, Examples of fields that uses digital mage processing
Textbook 1: Ch.1.3 to 1.5, Ch. 2.4,2.5
RBT: L1, L2</td><td>08</td></tr>
<tr><td colspan="4">Module 2</td><td></td></tr>
<tr><td colspan="4">Image Enhancement In The Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.
Textbook 1: Ch.3
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="4">Module 3</td><td></td></tr>
<tr><td colspan="4">Image Enhancement In Frequency Domain: Introduction, Fourier Transform, Discrete Fourier Transform (DFT), properties of DFT , Discrete Cosine Transform (DCT), Image filtering in frequency domain.
Textbook 1: Ch.4.1,4.2
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="4">Module 4</td><td></td></tr>
<tr><td colspan="4">Image Segmentation: Introduction, Detection of isolated points, line detection, Edge detection, Edge linking, Region based segmentation- Region growing, split and merge technique, local processing, regional processing, Hough transform, Segmentation using Threshold.
Textbook 1: Ch.10.1 to 10.3
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="4">Module 5</td><td></td></tr>
<tr><td colspan="4">Image Compression: Introduction, coding Redundancy , Inter-pixel redundancy, image compression model, Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, LZW coding, Transform Coding, Sub-image size selection, blocking, DCT implementation using FFT, Run length coding.
Textbook 1: Ch. 8.1 to 8.5
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="5">Course Outcomes: The student will be able to :</td></tr>
<tr><td colspan="5">• Explain fundamentals of image processing
• Compare transformation algorithms</td></tr>
</table>

• Contrast enhancement, segmentation and compression techniques
Question Paper Pattern:
• The question paper will have ten questions. • Each full Question consisting of 20 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module.
Textbooks:
1. Rafael C G., Woods R E. and Eddins S L, Digital Image Processing, Prentice Hall, 2nd edition, 2008.
Reference Books:
1. Milan Sonka,"Image Processing, analysis and Machine Vision", Thomson Press India Ltd, Fourth Edition. 2. Fundamentals of Digital Image Processing- Anil K. Jain, 2nd Edition, Prentice Hall of India. 3. S. Sridhar , Digital Image Processing, Oxford University Press, 2nd Ed, 2016. 4. Digital Image Processing (with Matlab and Labview), Vipul singh, elsiver.Filip learning

NETWORK MANAGEMENT
(Effective from the academic year 2018 -2019)
SEMESTER – VII

Course Code	**18CS742**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03

CREDITS –3

Course Learning Objectives: This course (18CS742) will enable students to:

- Illustrate the need for interoperable network management.
- Explain the concepts and architecture behind standards based network management.
- Differentiate the concepts and terminology associated with SNMP and TMN
- Describe network management as a typical distributed application

Module 1	**Contact Hours**
Introduction: Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP-Based Networks: The Internet and Intranets, Communications Protocols and Standards- Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology , Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management. **Textbook 1: Ch.1** **RBT: L1, L2**	08
Module 2	
Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1-Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model. **Textbook 1: Ch.3** **RBT: L1, L2**	08
Module 3	
SNMPv1 Network Management: Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMONI1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications. **Textbook 1: Ch. 4,5, Ch.8** **RBT: L1, L2**	08
Module 4	

Broadband Access Networks, Broadband Access Technology; HFCT Technology: The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable, Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the ADSL Access Network in an Overall Network, ADSL Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles **Textbook 1: Ch. 13** **RBT: L1, L2**	08
Module 5	
Network Management Applications: Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management- Fault Detection, Fault Location and Isolation 24 Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, CaseBased Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy- Based Management, Service Level Management. **Textbook 1: Ch.11** **RBT: L1, L2**	08
Course Outcomes: The student will be able to :	
• Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets. • Apply network management standards to manage practical networks • Formulate possible approaches for managing OSI network model. • Use on SNMP for managing the network • Use RMON for monitoring the behavior of the network • Identify the various components of network and formulate the scheme for the managing them	
Question Paper Pattern:	
• The question paper will have ten questions. • Each full Question consisting of 20 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module.	
Textbooks:	
1. Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010.	
Reference Books:	
1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.	

<table>
<tr><td colspan="4">NATURAL LANGUAGE PROCESSING
(Effective from the academic year 2018 -2019)
SEMESTER – VII</td></tr>
<tr><td>Course Code</td><td>18CS743</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Contact Hours/Week</td><td>3:0:0</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Contact Hours</td><td>40</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">CREDITS –3</td></tr>
<tr><td colspan="4">Course Learning Objectives: This course (18CS743) will enable students to:</td></tr>
<tr><td colspan="3">Module – 1</td><td>Contact Hours</td></tr>
<tr><td colspan="3">Overview and language modeling: Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.
Textbook 1: Ch. 1,2
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="4">Module – 2</td></tr>
<tr><td colspan="3">Word level and syntactic analysis: Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.
Textbook 1: Ch. 3,4
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="4">Module – 3</td></tr>
<tr><td colspan="3">Extracting Relations from Text: From Word Sequences to Dependency Paths:
Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation.
Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to Annotate Cases with Knowledge Roles and Evaluations.
A Case Study in Natural Language Based Web Search: InFact System Overview, The GlobalSecurity.org Experience.
Textbook 2: Ch. 3,4,5
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="4">Module – 4</td></tr>
<tr><td colspan="3">Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems,
Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures: Introduction, Cohesion, Coh-Metrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of Experiments.
Automatic Document Separation: A Combination of Probabilistic Classification and Finite-State Sequence Modeling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results.
Evolving Explanatory Novel Patterns for Semantically-Based Text Mining: Related Work, A Semantically Guided Model for Effective Text Mining.
Textbook 2: Ch. 6,7,8,9
RBT: L1, L2, L3</td><td>08</td></tr>
</table>

Module – 5	
INFORMATION RETRIEVAL AND LEXICAL RESOURCES: Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net-Stemmers-POS Tagger- Research Corpora. **Textbook 1: Ch. 9,12** **RBT: L1, L2, L3**	08

Course outcomes: The students should be able to:

- Analyze the natural language text.
- Define the importance of natural language.
- Understand the concepts Text mining.
- Illustrate information retrieval techniques.

Question paper pattern:

- The question paper will have ten questions.
- There will be 2 questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
2. Anne Kao and Stephen R. Poteet (Eds), "Natural LanguageProcessing and Text Mining", Springer-Verlag London Limited 2007.

Reference Books:

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: Anintroduction to Natural Language Processing, Computational Linguistics and SpeechRecognition", 2nd Edition, Prentice Hall, 2008.
2. James Allen, "Natural Language Understanding", 2nd edition, Benjamin/Cummingspublishing company, 1995.
3. Gerald J. Kowalski and Mark.T. Maybury, "Information Storage and Retrieval systems", Kluwer academic Publishers, 2000.

CRYPTOGRAPHY (Effective from the academic year 2018 -2019) SEMESTER – VII			
Course Code	**18CS744**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03
CREDITS –3			
Course Learning Objectives: This course (18CS744) will enable students to:			
• Define cryptography and its principles • Explain Cryptography algorithms • Illustrate Public and Private key cryptography • Explain Key management, distribution and ceritification • Explain authentication protocols • Tell about IPSec			

Module – 1	**Contact Hours**
Classical Encryption Techniques Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad. **Block Ciphers and the data encryption standard:** Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm **Textbook 1: Ch. 2.1,2.2, Ch. 3** **RBT: L1, L2**	08
Module – 2	
Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. public-key cryptanalysis. The RSA algorithm, desription of the algorithm, computational aspects, the security of RSA. **Other Public-Key Cryptosystems:** Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack,Elgamal Cryptographic systems **Textbook 1: Ch. 9, Ch. 10.1,10.2** **RBT: L1, L2**	08
Module – 3	
Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Zp, elliptic curves overGF(2m), Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA. **Key Management and Distribution:** Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory,public key	08

authority, public keys certificates. **Textbook 1: Ch. 10.3-10.5, Ch.14.1 to 14.3** **RBT: L1, L2**	
Module – 4	
X-509 certificates. Certificates, X-509 version 3, public key infrastructure .**User Authentication:** Remote user Authentication principles, Mutual Authentication, one wayAuthentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation , Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication. **Electronic Mail Security:** Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow. **Textbook 1: Ch. 14.4, Ch. 15.1 to 15.4, Ch.19** **RBT: L1, L2**	08
Module – 5	
IP Security: IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service **Transport and tunnel modes**, combining security associations, authentication plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits. **Textbook 1: Ch. 20.1 to 20.3** **RBT: L1, L2**	08
Course outcomes: The students should be able to:	
• Define cryptography and its principles • Explain Cryptography algorithms • Illustrate Public and Private key cryptography • Explain Key management, distribution and ceritification • Explain authentication protocols • Tell about IPSec	
Question paper pattern: • The question paper will have ten questions. • There will be 2 questions from each module. • Each question will have questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. William Stallings: Cryptography and Network Security, Pearson 6th edition.	
Reference Books:	
1. V K Pachghare: Cryptography and Information Security, PHI 2nd Edition.	

ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ

"ವಿಟಿಯು ಅಧಿನಿಯಮ ೧೯೯೪"ರ ಅಡಿಯಲ್ಲಿ ಕರ್ನಾಟಕ ಸರ್ಕಾರದಿಂದ ಸ್ಥಾಪಿತವಾದ ರಾಜ್ಯ ವಿಶ್ವವಿದ್ಯಾಲಯ

"ಜ್ಞಾನ ಸಂಗಮ", ಬೆಳಗಾವಿ-೫೯೦೦೧೮, ಕರ್ನಾಟಕ, ಭಾರತ

Visvesvaraya Technological University

(State University of Government of Karnataka Established as per the VTU Act, 1994)

"Jnana Sangama" Belagavi-590018, Karnataka, India

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Dr. A. S. Deshpande B.E., M.Tech., Ph.D.
Registrar

Phone: (0831) 2498100
Fax: (0831) 2405467

Ref: VTU/BGM/BOS/A9/2020-21 / 2719 Date: 23 SEP 2021

CIRCULAR

Subject: Updated syllabus of 18CS745 regarding...

Reference:

1. Approval of Chairperson BoS in CSE dated 08.09.2021
2. Approval of Hon'ble Vice-Chancellor, dated: 13.09.2021

This is to inform all concerned that the Professional Elective Course "**Robotic Process Automation Design & Development (18CS745)** in Computer Science and Engineering program has been modified to map with chapter contents of the prescribed textbook. The updated syllabus copy has been enclosed with the circular for kind reference to the stakeholders.

The principals of all the Engineering Colleges coming under the ambit of the University are hereby informed to bring the updated syllabus of 18CS745 to the notice of the faculty and students of the CSE / department of your college.

23.9.2021

REGISTRAR

Encl: As mentioned above.

To,

The Principals of all affiliated/ constituent /Autonomous Engineering Colleges, under the ambit of VTU Belagavi.

Copy to.

1. To the Hon'ble Vice-Chancellor through the secretary to VC, VTU Belagavi for information
2. The Registrar (Evaluation), VTU Belagavi for information.
3. The Regional Directors (I/c) of all the regional offices of VTU for circulation.
4. The Director ITI SMU CNC Belagavi for uploading on VTU website
5. PS to Registrar VTU Belagavi
6. All the concerned Special Officer/s and Caseworker/s of the academic section, VTU, Belagavi

ROBOTIC PROCESS AUTOMATION DESIGN & DEVELOPMENT
(Effective from the academic year 2018-2019)

SEMESTER–VII

CourseCode	**18CS745**	CIEMarks	40
NumberofContactHours/Week	3:0:0	SEEMarks	60
TotalNumberofContactHours	40	ExamHours	3Hrs
		CREDITS	03

Course Learning Objectives: This course(18CS745) will enable students to:

1. To understand basic concepts of RPA
2. To Describe RPA, where it can be applied and how it implemented
3. To Describe the different types of variables, Control Flow and data manipulation techniques
4. To Understand Image,Text and Data Tables Automation
5. To Describe various types of Exceptions and strategies to handle

Module–1	Contact Hours
RPA Foundations- What is RPA – Flavors of RPA- History of RPA- The Benefits of RPA- The downsides of RPA- RPA Compared to BPO, BPM and BPA – Consumer Willingness for Automation- The Workforce of the Future- RPA Skills-On-Premise Vs. the Cloud- Web Technology- Programming Languages and Low Code- OCR-Databases-APIs- AI-Cognitive Automation-Agile, Scrum, Kanban and Waterfall0 DevOps- Flowcharts. **Textbook 1: Ch 1, Ch 2, RBT:L1,L2**	08
Module–2	
RPA Platforms- Components of RPA- RPA Platforms-About Ui Path- About UiPath - The future of automation - Record and Play - Downloading and installing UiPath Studio -Learning Ui Path Studio- - Task recorder - Step-by-step examples using the recorder. **Textbook 2: Ch 1, Ch 2, RBT: L1, L2**	08
Module–3	
Sequence, Flowchart, and Control Flow-Sequencing the workflow-Activities-Control flow, various types of loops, and decision making-Step-by-step example using Sequence and Flowchart-Step-by-step example using Sequence and Control flow-Data Manipulation-Variables and Scope-Collections-Arguments – Purpose and use-Data table usage with examples-Clipboard management-File operation with step-by-step example-CSV/Excel to data table and vice versa (with a step-by-stepexample). **Textbook 2: Ch 3, Ch 4, RBT:L1,L2**	08
Module–4	
Taking Control of the Controls- Finding and attaching windows- Finding the control- Techniques for waiting for a control- Act on controls – mouse and keyboard activities- Working with UiExplorer- Handling events- Revisit recorder- Screen Scraping- When to use OCR- Types of OCR available- How to use OCR- Avoiding typical failure points. **Text book 2: Ch 5 RBT:L1,L2**	08

Module–5

Exception Handling, Debugging, and Logging- Exception handling- Common exceptions and ways to handle them- Logging and taking screenshots- Debugging techniques- Collecting crash dumps- Error reporting- Future of RPA 08

Text book 2: Ch 8 Text book 1: Ch 13 RBT:L1,L2

Courseoutcomes: Thestudentsshouldbeableto:

- To Understand the basic concepts of RPA
- To Describevarious components and platforms of RPA
- To Describe the different types of variables, control flow and data manipulation techniques
- To Understand various control techniques and OCR in RPA
- ToDescribevarioustypes andstrategies tohandle exceptions

Questionpaperpattern:

- The question paper will have tenquestions.
- There will be 2questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Tom Taulli, The Robotic Process Automation Handbook : A Guide to Implementing RPA Systems,2020, ISBN-13 (electronic): 978-1-4842-5729-6, Publisher : A press
2. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018 ISBN: 9781788470940

Reference Books:

1. Frank Casale, Rebecca Dilla, Heidi Jaynes ,Lauren Livingston,"Introduction to Robotic Process Automation: a Primer", Institute of Robotic Process Automation.
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant
3. Srikanth Merianda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation
4. https://www.uipath.com/rpa/robotic-process-automation

INTRODUCTION TO BIG DATA ANALYTICS (OPEN ELECTIVE) (Effective from the academic year 2018 -2019) SEMESTER – VII			
Course Code	**18CS751**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03
CREDITS –3			

Course Learning Objectives: This course (18CS751) will enable students to:

- Interpret the data in the context of the business.
- Identify an appropriate method to analyze the data
- Show analytical model of a system

Module – 1	Teaching Hours
Introduction to Data Analytics and Decision Making: Introduction, Overview of the Book, The Methods, The Software, Modeling and Models, Graphical Models, Algebraic Models, Spreadsheet Models, Seven-Step Modeling Process.**Describing the Distribution of a Single Variable**:Introduction,Basic Concepts, Populations and Samples, Data Sets,Variables,and Observations, Types of Data, Descriptive Measures for Categorical Variables, Descriptive Measures for Numerical Variables, Numerical Summary Measures, Numerical Summary Measures with StatTools,Charts for Numerical Variables, Time Series Data, Outliers and Missing Values,Outliers,Missing Values, Excel Tables for Filtering,Sorting,and Summarizing. **Finding Relationships among Variables**: Introduction, Relationships among Categorical Variables, Relationships among Categorical Variables and a Numerical Variable, Stacked and Unstacked Formats, Relationships among Numerical Variables, Scatterplots, Correlation and Covariance, Pivot Tables. **Textbook 1: Ch. 1,2,3** **RBT: L1, L2, L3**	08
Module – 2	
Probability and Probability Distributions:Introduction,Probability Essentials, Rule of Complements, Addition Rule, Conditional Probability and the Multiplication Rule, Probabilistic Independence, Equally Likely Events, Courseive Versus Objective Probabilities, Probability Distribution of a Single Random Variable, Summary Measures of a Probability Distribution, Conditional Mean and Variance, Introduction to Simulation. **Normal,Binormal,Poisson,and Exponential Distributions**:Introduction,The Normal Distribution, Continuous Distributions and Density Functions, The Normal Density,Standardizing:Z-Values,Normal Tables and Z-Values, Normal Calculations in Excel, Empirical Rules Revisited, Weighted Sums of Normal Random Variables, Applications of the Normal Random Distribution, The Binomial Distribution, Mean and Standard Deviation of the Binomial Distribution, The Binomial Distribution in the Context of Sampling, The Normal Approximation to the Binomial, Applications of the Binomial Distribution, The Poisson and Exponential Distributions, The Poisson Distribution, The Exponential Distribution. **Textbook 1: Ch. 4,5** **RBT: L1, L2, L3**	08
Module – 3	
Decision Making under Uncertainty:Introduction,Elements of Decision Analysis, Payoff	08

Tables, Possible Decision Criteria, Expected Monetary Value(EMY),Sensitivity Analysis, Decision Trees, Risk Profiles, The Precision Tree Add-In,Bayes' Rule, Multistage Decision Problems and the Value of Information, The Value of Information, Risk Aversion and Expected Utility, Utility Functions, Exponential Utility, Certainty Equivalents, Is Expected Utility Maximization Used? **Sampling and Sampling Distributions**: Introduction, Sampling Terminology, Methods for Selecting Random Samples, Simple Random Sampling, Systematic Sampling, Stratified Sampling, Cluster Sampling, Multistage Sampling Schemes, Introduction to Estimation, Sources of Estimation Error, Key Terms in Sampling, Sampling Distribution of the Sample Mean, The Central Limit Theorem, Sample Size Selection, Summary of Key Ideas for Simple Random Sampling. **Textbook 1: Ch. 6,7** **RBT: L1, L2, L3**	
Module – 4	
Confidence Interval Estimation: Introduction, Sampling Distributions, The t Distribution, Other Sampling Distributions, Confidence Interval for a Mean, Confidence Interval for a Total, Confidence Interval for a Proportion, Confidence Interval for a Standard Deviation, Confidence Interval for the Difference between Means, Independent Samples, Paired Samples, Confidence Interval for the Difference between Proportions, Sample Size Selection, Sample Size Selection for Estimation of the Mean, Sample Size Selection for Estimation of Other Parameters. **Hypothesis Testing**:Introduction,Concepts in Hypothesis Testing, Null and Alternative Hypothesis, One-Tailed Versus Two-Tailed Tests, Types of Errors, Significance Level and Rejection Region, Significance from p-values, Type II Errors and Power, Hypothesis Tests and Confidence Intervals, Practical versus Statistical Significance, Hypothesis Tests for a Population Mean, Hypothesis Tests for Other Parameters, Hypothesis Tests for a Population Proportion, Hypothesis Tests for Differences between Population Means, Hypothesis Test for Equal Population Variances, Hypothesis Tests for Difference between Population Proportions, Tests for Normality, Chi-Square Test for Independence. **Textbook 1: Ch. 8,9** **RBT: L1, L2, L3**	08
Module – 5	
Regression Analysis: Estimating Relationships: Introduction, Scatterplots : Graphing Relationships, Linear versus Nonlinear Relationships,Outliers,Unequal Variance, No Relationship,Correlations:Indications of Linear Relationships, Simple Linear Regression, Least Squares Estimation, Standard Error of Estimate, The Percentage of Variation Explained:R-Square,Multiple Regression, Interpretation of Regression Coefficients, Interpretation of Standard Error of Estimate and R-Square, Modeling Possibilities, Dummy Variables, Interaction Variables, Nonlinear Transformations, Validation of the Fit. **Regression Analysis**: Statistical Inference:Introduction,The Statistical Model, Inferences About the Regression Coefficients, Sampling Distribution of the Regression Coefficients, Hypothesis Tests for the Regression Coefficients and p-Values, A Test for the Overall Fit: The ANOVA Table,Multicollinearity,Include/Exclude Decisions, Stepwise Regression,Outliers,Violations of Regression Assumptions,Nonconstant Error Variance,Nonnormality of Residuals,Autocorrelated Residuals ,Prediction. **Textbook 1: Ch. 10,11** **RBT: L1, L2, L3**	08
Course outcomes: The students should be able to:	
• Explain the importance of data and data analysis • Interpret the probabilistic models for data	

• Define hypothesis, uncertainty principle • Evaluate regression analysis
Question Paper Pattern:
• The question paper will have ten questions. • Each full Question consisting of 20 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module.
Text Books:
1. S C Albright and W L Winston, Business analytics: data analysis and decision making, 5/e Cenage Learning
Reference Books:
1. ArshdeepBahga, Vijay Madisetti, "Big Data Analytics: A Hands-On Approach", 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577 2. Raj Kamal and Preeti Saxena, “Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning”, McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966

PYTHON APPLICATION PROGRAMMING (OPEN ELECTIVE) (Effective from the academic year 2018 -2019) SEMESTER – VI			
Course Code	**18CS752**	**IA Marks**	40
Number of Lecture Hours/Week	3:0:0	**Exam Marks**	60
Total Number of Lecture Hours	40	**Exam Hours**	03
CREDITS – 03			

Course Learning Objectives: This course (18CS752) will enable students to

- Learn Syntax and Semantics and create Functions in Python.
- Handle Strings and Files in Python.
- Understand Lists, Dictionaries and Regular expressions in Python.
- Implement Object Oriented Programming concepts in Python
- Build Web Services and introduction to Network and Database Programmingin Python.

Module – 1	Teaching Hours
Why should you learn to write programs, Variables, expressions and statements, Conditional execution, Functions **Textbook 1: Chapters 1 – 4** **RBT: L1, L2, L3**	08
Module – 2	
Iteration, Strings, Files **Textbook 1: Chapters 5– 7** **RBT: L1, L2, L3**	08
Module – 3	
Lists, Dictionaries, Tuples, Regular Expressions **Textbook 1: Chapters 8 - 11** **RBT: L1, L2, L3**	08
Module – 4	
Classes and objects, Classes and functions, Classes and methods **Textbook 2: Chapters 15 – 17** **RBT: L1, L2, L3**	08
Module – 5	
Networked programs, Using Web Services, Using databases and SQL **Textbook 1: Chapters 12– 13, 15** **RBT: L1, L2, L3**	08

Course Outcomes: After studying this course, students will be able to

- Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.
- Demonstrate proficiency in handling Strings and File Systems.
- Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
- Interpret the concepts of Object-Oriented Programming as used in Python.
- Implement exemplary applications related to Network Programming, Web Services and Databases in Python.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks

• There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module.
Text Books:
1. Charles R. Severance, **“Python for Everybody: Exploring Data Using Python 3”,** 1st Edition, CreateSpace Independent Publishing Platform, 2016. (http://do1.dr-chuck.com/pythonlearn/EN_us/pythonlearn.pdf) 2. Allen B. Downey, **"Think Python: How to Think Like a Computer Scientist”,** 2ndEdition, Green Tea Press, 2015. (http://greenteapress.com/thinkpython2/thinkpython2.pdf) (Download pdf files from the above links)
Reference Books:
1. Charles Dierbach, **"Introduction to Computer Science Using Python",**1st Edition, Wiley India Pvt Ltd, 2015. ISBN-13: 978-8126556014 2. Gowrishankar S, Veena A, **“Introduction to Python Programming”,** 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372 3. Mark Lutz, **“Programming Python”,**4th Edition, O’Reilly Media, 2011.ISBN-13: 978-9350232873 4. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, **“Data Structures and Algorithms in Python”,**1stEdition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126562176 5. Reema Thareja, **“Python Programming Using Problem Solving Approach”,** Oxford university press, 2017. ISBN-13: 978-0199480173

<table>
<tr><td colspan="5">INTRODUCTION TO ARTIFICIAL INTELLIGENCE
(OPEN ELECTIVE)
(Effective from the academic year 2018 -2019)
SEMESTER – VII</td></tr>
<tr><td>Course Code</td><td>18CS753</td><td>CIE Marks</td><td colspan="2">40</td></tr>
<tr><td>Number of Contact Hours/Week</td><td>3:0:0</td><td>SEE Marks</td><td colspan="2">60</td></tr>
<tr><td>Total Number of Contact Hours</td><td>40</td><td>Exam Hours</td><td colspan="2">03</td></tr>
<tr><td colspan="5">CREDITS –3</td></tr>
<tr><td colspan="5">Course Learning Objectives: This course (18CS753) will enable students to:</td></tr>
<tr><td colspan="5">Identify the problems where AI is required and the different methods available
Compare and contrast different AI techniques available.
Define and explain learning algorithms</td></tr>
<tr><td colspan="4">Module – 1</td><td>Teaching Hours</td></tr>
<tr><td colspan="4">What is artificial intelligence?, Problems, Problem Spaces and search
TextBook1: Ch 1, 2
RBT: L1, L2</td><td>08</td></tr>
<tr><td colspan="5">Module – 2</td></tr>
<tr><td colspan="4">Knowledge Representation Issues, Using Predicate Logic, Representing knowledge using Rules,
TextBoook1: Ch 4, 5 and 6.
RBT: L1, L2</td><td>08</td></tr>
<tr><td colspan="5">Module – 3</td></tr>
<tr><td colspan="4">Symbolic Reasoning under Uncertainty, Statistical reasoning
TextBoook1: Ch 7, 8
RBT: L1, L2</td><td>08</td></tr>
<tr><td colspan="5">Module – 4</td></tr>
<tr><td colspan="4">Game Playing, Natural Language Processing
TextBoook1: Ch 12 and 15
RBT: L1, L2</td><td>08</td></tr>
<tr><td colspan="5">Module – 5</td></tr>
<tr><td colspan="4">Learning, Expert Systems.
TextBook1: Ch 17 and 20
RBT: L1, L2</td><td>08</td></tr>
<tr><td colspan="5">Course outcomes: The students should be able to:</td></tr>
<tr><td colspan="5">Identify the AI based problems
Apply techniques to solve the AI problems
Define learning and explain various learning techniques
Discuss on expert systems</td></tr>
<tr><td colspan="5">Question paper pattern:</td></tr>
<tr><td colspan="5">The question paper will have ten questions.
Each full Question consisting of 20 marks
There will be 2 full questions (with a maximum of four sub questions) from each module.
Each full question will have sub questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.</td></tr>
<tr><td colspan="5">Text Books:</td></tr>
</table>

1. E. Rich , K. Knight & S. B. Nair - Artificial Intelligence, 3/e, McGraw Hill.
Reference Books:
1. Artificial Intelligence: A Modern Approach, Stuart Rusell, Peter Norving, Pearson Education 2nd Edition. 2. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems – Prentice Hal of India. 3. G. Luger, “Artificial Intelligence: Structures and Strategies for complex problem Solving”, Fourth Edition, Pearson Education, 2002. 4. Artificial Intelligence and Expert Systems Development by D W Rolston-Mc Graw hill. 5. N.P. Padhy “Artificial Intelligence and Intelligent Systems” , Oxford University Press-2015

<table>
<tr><td colspan="5" align="center">INTRODUCTION TO DOT NET FRAMEWORK FOR APPLICATION DEVELOPMENT
(OPEN ELECTIVE)
(Effective from the academic year 2018 -2019)
SEMESTER – VII</td></tr>
<tr><td>Course Code</td><td>18CS754</td><td>CIE Marks</td><td colspan="2">40</td></tr>
<tr><td>Number of Contact Hours/Week</td><td>3:0:0</td><td>SEE Marks</td><td colspan="2">60</td></tr>
<tr><td>Total Number of Contact Hours</td><td>40</td><td>Exam Hours</td><td colspan="2">03</td></tr>
<tr><td colspan="5" align="center">CREDITS –3</td></tr>
<tr><td colspan="5">Course Learning Objectives: This course (18CS754) will enable students to:</td></tr>
<tr><td colspan="5">Inspect Visual Studio programming environment and toolset designed to build applications for Microsoft Windows
Understand Object Oriented Programming concepts in C# programming language.
Interpret Interfaces and define custom interfaces for application.
Build custom collections and generics in C#
Construct events and query data using query expressions</td></tr>
<tr><td colspan="4">Module – 1</td><td>Teaching Hours</td></tr>
<tr><td colspan="4">Introducing Microsoft Visual C# and Microsoft Visual Studio 2015: Welcome to C#, Working with variables, operators and expressions, Writing methods and applying scope, Using decision statements, Using compound assignment and iteration statements, Managing errors and exceptions
T1: Chapter 1 – Chapter 6
RBT: L1, L2</td><td>08</td></tr>
<tr><td colspan="5">Module – 2</td></tr>
<tr><td colspan="4">Understanding the C# object model: Creating and Managing classes and objects, Understanding values and references, Creating value types with enumerations and structures, Using arrays
Textbook 1: Ch 7 to 10
RBT: L1, L2</td><td>08</td></tr>
<tr><td colspan="5">Module – 3</td></tr>
<tr><td colspan="4">Understanding parameter arrays, Working with inheritance, Creating interfaces and defining abstract classes, Using garbage collection and resource management
Textbook 1: Ch 11 to 14
RBT: L1, L2</td><td>08</td></tr>
<tr><td colspan="5">Module – 4</td></tr>
<tr><td colspan="4">Defining Extensible Types with C#: Implementing properties to access fields, Using indexers, Introducing generics, Using collections
Textbook 1: Ch 15 to 18
RBT: L1, L2</td><td>08</td></tr>
<tr><td colspan="5">Module – 5</td></tr>
<tr><td colspan="4">Enumerating Collections, Decoupling application logic and handling events, Querying in-memory data by using query expressions, Operator overloading
Textbook 1: Ch 19 to 22
RBT: L1, L2</td><td>08</td></tr>
<tr><td colspan="5">Course outcomes: The students should be able to:</td></tr>
<tr><td colspan="5">Build applications on Visual Studio .NET platform by understanding the syntax and semantics of C#
Demonstrate Object Oriented Programming concepts in C# programming language</td></tr>
</table>

- Design custom interfaces for applications and leverage the available built-in interfaces in building complex applications.
- Illustrate the use of generics and collections in C#
- Compose queries to query in-memory data and define own operator behaviour

Question paper pattern:

The question paper will have TEN questions.
There will be TWO questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. John Sharp, Microsoft Visual C# Step by Step, 8th Edition, PHI Learning Pvt. Ltd. 2016

Reference Books:

1. Christian Nagel, "C# 6 and .NET Core 1.0", 1st Edition, Wiley India Pvt Ltd, 2016. Andrew Stellman and Jennifer Greene, "Head First C#", 3rd Edition, O'Reilly Publications, 2013.
2. Mark Michaelis, "Essential C# 6.0", 5th Edition, Pearson Education India, 2016.
3. Andrew Troelsen, "Prof C# 5.0 and the .NET 4.5 Framework", 6th Edition, Apress and Dreamtech Press, 2012.

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LABORATORY (Effective from the academic year 2018 -2019) SEMESTER – VII			
Course Code	**18CSL76**	**CIE Marks**	40
Number of Contact Hours/Week	0:0:2	**SEE Marks**	60
Total Number of Lab Contact Hours	36	**Exam Hours**	03
Credits – 2			

Course Learning Objectives: This course (18CSL76) will enable students to:

- Implement and evaluate AI and ML algorithms in and Python programming language.

Descriptions (if any):

Installation procedure of the required software must be demonstrated, carried out in groups and documented in the journal.

Programs List:

1.	Implement A* Search algorithm.
2.	Implement AO* Search algorithm.
3.	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithmto output a description of the set of all hypotheses consistent with the training examples.
4.	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge toclassify a new sample.
5.	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
6.	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
7.	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
8.	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
9.	Implement the non-parametric Locally Weighted Regressionalgorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs

Laboratory Outcomes: The student should be able to:

- Implement and demonstrate AI and ML algorithms.
- Evaluate different algorithms.

Conduct of Practical Examination:

- Experiment distribution
  - o For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
  - o For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.
- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution *(Courseed to change in accoradance with university regulations)*
  - q) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
  - r) For laboratories having PART A and PART B
    - i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
    - ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

INTERNET OF THINGS (Effective from the academic year 2018 -2019) SEMESTER – VIII			
Course Code	**18CS81**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03

CREDITS –3

Course Learning Objectives: This course (18CS81) will enable students to:

- Assess the genesis and impact of IoT applications, architectures in real world.
- Illustrate diverse methods of deploying smart objects and connect them to network.
- Compare different Application protocols for IoT.
- Infer the role of Data Analytics and Security in IoT.
- Identifysensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry.

Module 1	**Contact Hours**
What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack. **Textbook 1: Ch.1, 2** **RBT: L1, L2, L3**	08
Module 2	
Smart Objects: The “Things” in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies. **Textbook 1: Ch.3, 4** **RBT: L1, L2, L3**	08
Module 3	
IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods. **Textbook 1: Ch.5, 6** **RBT: L1, L2, L3**	08
Module 4	
Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment **Textbook 1: Ch.7, 8** **RBT: L1, L2, L3**	08
Module 5	
IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT	08

Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples. **Textbook 1: Ch.12** **Textbook 2: Ch.7.1 to 7.4, Ch.8.1 to 8.4, 8.6** **RBT: L1, L2, L3**	

Course Outcomes: The student will be able to :

- Interpret the impact and challenges posed by IoT networks leading to new architectural models.
- Compare and contrast the deployment of smart objects and the technologies to connect them to network.
- Appraise the role of IoT protocols for efficient network communication.
- Elaborate the need for Data Analytics and Security in IoT.
- Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,**"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things",** 1stEdition, Pearson Education (Cisco Press Indian Reprint). (**ISBN:** 978-9386873743)
2. Srinivasa K G, **"Internet of Things",**CENGAGE Leaning India, 2017

Reference Books:

1. Vijay Madisetti and ArshdeepBahga, **"Internet of Things (A Hands-on-Approach)",** 1stEdition, VPT, 2014. (**ISBN:** 978-8173719547)
2. Raj Kamal, **"Internet of Things: Architecture and Design Principles",** 1st Edition, McGraw Hill Education, 2017. (**ISBN:** 978-9352605224)

Mandatory Note:

Distribution of CIE Marks is a follows (Total 40 Marks):

- 20 Marks through IA Tests
- 20 Marks through practical assessment

Maintain a copy of the report for verification during LIC visit.

Posssible list of practicals:

1. Transmit a string using UART
2. Point-to-Point communication of two Motes over the radio frequency.
3. Multi-point to single point communication of Motes over the radio frequency.LAN (Sub-netting).
4. I2C protocol study
5. Reading Temperature and Relative Humidity value from the sensor

MOBILE COMPUTING (Effective from the academic year 2018 -2019) SEMESTER – VIII			
Course Code	**18CS821**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03
CREDITS –3			

Course Learning Objectives: This course (18CS821) will enable students to:

- Define concepts of wireless communication.
- Compare and contrast propagation methods, Channel models, capacity calculations multiple antennas and multiple user techniques used in the mobile communication.
- Explain CDMA, GSM. Mobile IP, WImax and Different Mobile OS
- Illustrate various Markup Languages CDC, CLDC, MIDP; Programming for CLDC, MIDlet model and security concerns

Module 1	**Contact Hours**
Mobile Computing Architecture: Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. Emerging Technologies: Wireless broadband (WiMAX), Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6. Wireless Networks : Global Systems for Mobile Communication (GSM): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Short Service Messages (SMS): Introduction to SMS, SMS Architecture, SMMT, SMMO, SMS as Information bearer, applications **Textbook1: 2.4 - 2.6, 4.4 - 4.6, 5, 6.** **RBT: L1, L2**	08
Module 2	
GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS. Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G, Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices. **Textbook 1: 7,9.2 - 9.7, 12.2 - 12.6** **RBT: L1, L2**	08
Module 3	
Mobile OS and Computing Environment: Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux, Proprietary OS Client Development: The development process, Need analysis phase, Design phase, Implementation and Testing phase, Deployment phase, Development Tools, Device Emulators **Textbook 2: 7, 8.** **RBT: L1, L2**	08
Module 4	
Building Wireless Internet Applications: Thin client overview: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications	08

Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, 10 Hours HTML, cHTML, XHTML, VoiceXML. **Textbook 2: 11, 12, 13** **RBT: L1, L2**	
Module 5	
J2ME: Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet life-cycle, Creating new application, MIDlet event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP. **Textbook 1: 15.1 - 15.10** **RBT: L1, L2**	08
Course Outcomes: The student will be able to :	
The students shall able to: • Explain state of art techniques in wireless communication. • Discover CDMA, GSM. Mobile IP, WImax • Demonstrate program for CLDC, MIDP let model and security concerns	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: 1. Ashok Talukder, Roopa Yavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010. 2. Martyn Mallik: Mobile and Wireless Design Essentials, Wiley India, 2003	
Reference Books: 1. Raj kamal: Mobile Computing, Oxford University Press, 2007. 2. Iti Saha Misra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.	

STORAGE AREA NETWORKS (Effective from the academic year 2018 -2019) SEMESTER – VII			
Course Code	**18CS822**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03
CREDITS –3			

Course Learning Objectives: This course (18CS822) will enable students to:

- Evaluate storage architectures,
- Define backup, recovery, disaster recovery, business continuity, and replication
- Examine emerging technologies including IP-SAN
- Understand logical and physical components of a storage infrastructure
- Identify components of managing and monitoring the data center
- Define information security and identify different storage virtualization technologies

Module 1	**Contact Hours**
Storage System: Introduction to Information Storage: Information Storage, Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing. **Data Center Environment:** Application Database Management System (DBMS), Host (Compute), Connectivity, Storage, Disk Drive Components,Disk Drive Performance, Host Access to Data, Direct-Attached Storage, Storage Design Based on Application **Textbook1 : Ch.1.1 to 1.4, Ch.2.1 to 2.10** **RBT: L1, L2**	08
Module 2	
Data Protection - RAID : RAID Implementation Methods, RAID Array Components, RAID Techniques, RAID Levels, RAID Impact on Disk Performance, RAID Comparison. **Intelligent Storage Systems :** Components of an Intelligent Storage System, Types of Intelligent Storage Systems. **Fibre Channel Storage Area Networks - Fibre Channel:** Overview, The SAN and Its Evolution, Components of FC SAN. **Textbook1 : Ch.3.1 to 3.6, Ch. 4.1, 4.3, Ch. 5.1 to 5.3** **RBT: L1, L2**	08
Module 3	
IP SAN and FCoE: iSCSI, FCIP, **Network-Attached Storage:** General-Purpose Servers versus NAS Devices,Benefi ts of NAS, File Systems and Network File Sharing, Components of NAS, NAS I/O Operation, NAS Implementations, NAS File-Sharing Protocols, Factors Affecting NAS Performance **Textbook1 : Ch.6.1, 6.2, Ch. 7.1 to 7.8** **RBT: L1, L2**	08
Module 4	
Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning Life Cycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions, **Backup and Archive:** Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments **Textbook1 : Ch.9.1 to 9.6, Ch. 10.1 to 10.9** **RBT: L1, L2**	08
Module 5	
Local Replication: Replication Terminology, Uses of Local Replicas, Replica Consistency , Local Replication Technologies, Tracking Changes to Source and Replica, Restore and Restart Considerations, Creating Multiple Replicas. **Remote Replication:** Modes of Remote	08

Replication, Remote Replication Technologies. **Securing the Storage Infrastructure:** Information Security Framework, Risk Triad, Storage Security Domains. Security Implementations in Storage Networking **Textbook1 : Ch.11.1 to 11.7, Ch. 12.1, 12.2, Ch. 14.1 to 14.4** **RBT: L1, L2**	

Course Outcomes: The student will be able to :

- Identify key challenges in managing information and analyze different storage networking technologies and virtualization
- Explain components and the implementation of NAS
- Describe CAS architecture and types of archives and forms of virtualization
- Illustrate the storage infrastructure and management activities

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. EMC Education Services, **"Information Storage and Management"**, Wiley India Publications, 2009. ISBN: 9781118094839

Reference Books:

1. Paul Massiglia, Richard Barker, **"Storage Area Network Essentials: A Complete Guide to Understanding and Implementating SANs Paperback",** 1st Edition, Wiley India Publications, 2008

<table>
<tr><td colspan="5" align="center">NOSQL DATABASE
(Effective from the academic year 2018 -2019)
SEMESTER – VIII</td></tr>
<tr><td>Course Code</td><td>18CS823</td><td colspan="2">CIE Marks</td><td>40</td></tr>
<tr><td>Number of Contact Hours/Week</td><td>3:0:0</td><td colspan="2">SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Contact Hours</td><td>40</td><td colspan="2">Exam Hours</td><td>03</td></tr>
<tr><td colspan="5" align="center">CREDITS –3</td></tr>
<tr><td colspan="5">Course Learning Objectives: This course (18CS823) will enable students to:</td></tr>
<tr><td colspan="5">Define, compare and use the four types of NoSQL Databases (Document-oriented, KeyValue Pairs, Column-oriented and Graph).
Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.
Explain the detailed architecture, define objects, load data, query data and performance tune Document-oriented NoSQL databases.</td></tr>
<tr><td colspan="4">Module 1</td><td>Contact Hours</td></tr>
<tr><td colspan="4">Why NoSQL? The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, A (Mostly) Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL,
Aggregate Data Models; Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column-Family Stores, Summarizing Aggregate-Oriented Databases.
More Details on Data Models; Relationships, Graph Databases, Schemaless Databases, Materialized Views, Modeling for Data Access,
Textbook1: Chapter 1,2,3
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="4">Module 2</td><td></td></tr>
<tr><td colspan="4">Distribution Models; Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.
Consistency, Update Consistency, Read Consistency, Relaxing Consistency, The CAP Theorem, Relaxing Durability, Quorums.
Version Stamps, Business and System Transactions, Version Stamps on Multiple Nodes
Textbook1: Chapter 4,5,6
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="4">Module 3</td><td></td></tr>
<tr><td colspan="4">Map-Reduce, Basic Map-Reduce, Partitioning and Combining, Composing Map-Reduce Calculations, A Two Stage Map-Reduce Example, Incremental Map-Reduce
Key-Value Databases, What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preference, Shopping Cart Data, When Not to Use, Relationships among Data, Multioperation Transactions, Query by Data, Operations by Sets
Textbook1: Chapter 7,8
RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="4">Module 4</td><td></td></tr>
<tr><td colspan="4">Document Databases, What Is a Document Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, When Not to Use, Complex Transactions Spanning Dif erent Operations, Queries against Varying Aggregate Structure
Textbook1: Chapter 9</td><td>08</td></tr>
</table>

RBT: L1, L2, L3	
Module 5	
Graph Databases, What Is a Graph Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch, and Location-Based Services, Recommendation Engines, When Not to Use. **Textbook1: Chapter 11** **RBT: L1, L2, L3**	08

Course Outcomes: The student will be able to :

- Define, compare and use the four types of NoSQL Databases (Document-oriented, KeyValue Pairs, Column-oriented and Graph).
- Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.
- Explain the detailed architecture, define objects, load data, query data and performance tune Document-oriented NoSQL databases.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addision Wesley, 2012

Reference Books:

1. Dan Sullivan, "NoSQL For Mere Mortals", 1st Edition, Pearson Education India, 2015. (ISBN-13: 978-9332557338)
2. Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2013. (ISBN-13: 978-9351192022)
3. Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013. (ISBN-13: 978-9351102694)

MULTICORE ARCHITECTURE AND PROGRAMMING (Effective from the academic year 2018 -2019) SEMESTER – VII			
Course Code	**18CS824**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03
CREDITS –3			

Course Learning Objectives: This course (18CS824) will enable students to:

- Define technologies of multicore architecture and performance measures
- Demonstrate problems related to multiprocessing
- Illustrate windows threading, posix threads, openmp programming
- Analyze the common problems in parallel programming

Module -1	Contact Hours
Introduction to Multi-core Architecture Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper- Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law. System Overview of Threading : Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization. **Textbook 1: Ch.1, 2** **RBT: L1, L2, L3**	08
Module -2	
Fundamental Concepts of Parallel Programming :Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives. Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features **Textbook 1: Ch.3, 4** **RBT: L1, L2, L3**	08
Module – 3	
Threading APIs :ThreadingAPls for Microsoft Windows, Win32/MFC Thread APls, Threading APls for Microsoft. NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking. **Textbook 1: Ch.5** **RBT: L1, L2, L3**	08
Module-4	
OpenMP: A Portable Solution for Threading : Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions,	08

OpenMP Environment Variables, Compilation, Debugging, performance **Textbook 1: Ch.6** **RBT: L1, L2, L3**	
Module-5	
Solutions to Common Parallel Programming Problems : Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32,Data Organization for High Performance. **Textbook 1: Ch.7** **RBT: L1, L2, L3**	08

Course Outcomes: The student will be able to :

- Identify the limitations of ILP and the need for multicore architectures
- Define fundamental concepts of parallel programming and its design issues
- Solve the issues related to multiprocessing and suggest solutions
- Make out the salient features of different multicore architectures and how they exploit parallelism
- Demonstrate the role of OpenMP and programming concept

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Multicore Programming , Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006

Reference Books:

1. Yan Solihin, "Fundamentals of Parallel Multicore Architecture", 1st Edition, CRC Press/Taylor and Francis, 2015.
2. GerassimosBarlas, "Multicore and GPU Programming: An Integrated Approach Paperback", 1st Edition, Morgan Kaufmann, 2014.
3. Lyla B Das, "The x86 Microprocessors: 8086 to Pentium, Multicores, Atom and the 8051 Microcontroller: Architecture, Programming and Interfacing", 2nd Edition, Pearson Education India, 2014

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Scheme of Teaching and Evaluation for
B. E-III & IV Semester
Electronics & Comm. Engg. Program

3rd / 4th Semester Scheme
(Effective from the academic year 2021-22)

APPROVED COPY

DEPARTMENT OF ELECTRONICS & COMM. ENGG.
Semester III

SN	Couse category	Course Code	Course	BOS / Teaching Department	BOE / Paper Setting Board	Teaching Hours per Week			Credits	Duration of Exam	Marks		
						L	T	P			CIE	SEE	Total
01	BSC	21MEE31	Transform Calculus & Numerical Methods	Mathematics	Mathematics	3	0	0	3	3	50	50	100
02	IPCC	21EC32	Basic Signal Processing	E&C Engg	E&C Engg	3	0	2	4	3	50	50	100
03	PCC	21EC33	Digital Circuit Design using Verilog	E&C Engg	E&C Engg	3	0	0	3	3	50	50	100
04	PCC	21EC34	Analog Electronic Circuits	E&C Engg	E&C Engg	3	0	0	3	3	50	50	100
05	PCC	21ECL35	Digital Circuit Design Laboratory	E&C Engg	E&C Engg	0	0	2	1	3	50	50	100
06	PCC	21ECL36	Analog Electronic Circuits Laboratory	E&C Engg	E&C Engg	0	0	2	1	3	50	50	100
07	HS	21KSK37/ 47	Samskrutika Kannada	Humanities	Humanities	1	0	0	1	-	100	----	100
		21KBK37/ 47	Balake Kannada										
		OR											
	HS	21CIP37/ 47	Constitution of India, Professional Ethics and Cyber Law						1	2	50	50	
08	AEC	21AEC38	Programming with Hardware Controllers	E&C Engg	E&C Engg	0	0	2	1	2	50	50	100
09	AEC	21DTI39	Ability Enhancement Course (Design Thinking and Innovation)	E&C Engg	E&C Engg	1	0	0	1	2	50	50	100
	Total								**18**		**500/ 450**	**400/ 450**	**900**
Course prescribed to lateral entry Diploma holders admitted to III semester B.E./B.Tech programs													
10	NCMC	21MATDIP31	Additional Mathematics - I	Mathematics	-	3	0	0	0	-	100	-	100

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical of the same course. Credits for IPCC are 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE

DEPARTMENT OF ELECTRONICS & COMM. ENGG.
Semester IV

SN	Couse category	Course Code	Course	BOS / Teaching Department	BOE / Paper Setting Board	Teaching Hours per Week			Credits	Duration of Exam	Marks		
						L	T	P			CIE	SEE	Total
01	BSC	21MCE41	Linear Algebra, Probability and Statistical Methods	Mathematics	Mathematics	3	0	0	3	3	50	50	100
02	IPCC	21EC42	Network Theory & Control Systems	E&C Engg	E&C Engg	3	0	2	4	3	50	50	100
03	PCC	21EC43	Digital Signal Processing	E&C Engg	E&C Engg	3	0	0	3	3	50	50	100
04	PCC	21EC44	Communication Systems-I	E&C Engg	E&C Engg	3	0	0	3	3	50	50	100
05	PCC	21ECL45	Digital Signal Processing Laboratory	E&C Engg	E&C Engg	0	0	2	1	3	50	50	100
06	PCC	21ECL46	Communication Laboratory-I	E&C Engg	E&C Engg	0	0	2	1	3	50	50	100
07	HS	21KSK37/ 47	Samskrutika Kannada	HSMC	HSMC	1	0	0	1	--	100	---	100
		21KBK37/ 47	Balake Kannada										
		OR											
	HS	21CIP37/47	Constitution of India, Professional Ethics and Cyber Law						1	2	50	50	
08	AEC	21SSA480	Soft skills and basic aptitude	Humanities	Humanities	1	2	0	2	2	50	50	100
09	AEC	21AEC482	Digital System Design with FPGA	E&C Engg	E&C Engg	1	0	0	1	2	50	50	100
10	UHV	21UHV490	Universal Human Values	Concerned Department	ANY DEPT.	1	0	0	1	2	50	50	100
11	INT	21INT491	Summer Internship - I	Evaluation By the appropriate authorities		Completed during the intervening period of II and III semesters. Lateral entry students have to attend the internship during the intervening period of III and IV semesters			2	----	100	--	100
		Total							**22**		**600/ 650**	**500/ 450**	**1100**
Course prescribed to lateral entry Diploma holders admitted to III semester B.E./B.Tech programs													
12	NCMC	21MATDIP41	Additional Mathematics - II	Mathematics	-	3	0	0	0	-	100	-	100

Semester: III
(COMMON TO ECE & EEE)

Course Name: Transform Calculus & Numerical Methods

Course Code	21MEE31	CIE Marks	50
Teaching Hours / Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Pre-requisites:
- Basic formulae of differentiation, partial differentiation, Integration.
- Differential equations
- Periodic function

Module-1

Fourier Series: Introduction to infinite series, Periodic functions, Dirichlet's conditions, Euler's formulae. Fourier series of periodic functions with period 2π. Fourier series of even and odd functions and Fourier series of arbitrary period $2l$. Problems on time periodic signals. Practical harmonic analysis.
Self -Study: Convergence and Divergence of series. **8 Hours**

Module-2

Infinite Fourier Transforms
Representation of periodic and non-periodic functions, continuous time Fourier Transform, Properties of Fourier Transform (without Proof). Discrete time Fourier Transform, Properties of DTFT (without Proof).
Self -Study: Leibnitz rule for differentiation under integral sign. **8 Hours**

Module-3

Z-Transforms: Z-transform-definition, Z-transforms of standard functions, Region of convergence, properties-Linearity, scaling, Shifting theorem with Problems. Inverse Z- transforms and applications to solve difference equations. Transform analysis of LTI system transfer function.
Self-Study: Initial and final value theorem. **8 Hours**

Module-4

Numerical Solution of first-Order ODEs
Taylor's series method, Modified Euler's method, Runge-Kutta method of order four, Milne's predictor and corrector formula, Adam's-Bash forth formula (No derivations only formulae).
Self-Study: Solution of first order ODE using Picard's method. **8 Hours**

Module-5

Numerical Solution of Simultaneous and Second-Order ODEs
Simultaneous differential Equations: Picard's method, Runge-Kutta method. (No derivations of formulae).
Second-order differential equations: Runge-Kutta method and Milne's predictor and corrector method. (No derivations of formulae).
Self-Study: Solution of ODE by analytical method. **8 Hours**

Course Outcomes:
Upon completion of this course, student will be able to:
1. Demonstrate Fourier series to study the behavior of periodic functions and their applications in system communications, digital signal processing and field theory.
2. Make use of Fourier Transform to illustrate discrete / continuous function arising in wave and Heat propagation, signals and systems.
3. To apply Z- Transform techniques to solve difference equations.
4. Solve first order ODE arising in engineering problems using single step numerical methods.
5. Solve second order ODE arising in engineering problems using single step numerical methods.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author / s	Name of the Publisher	Edition and Year
Textbooks				
1	Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers	43rd Ed. 2015
2	Advanced Engineering Mathematics	E. Kreyszig	John willy & Sons	10th Ed. (Reprint). 2016
3	Signals & Systems	ALAN V. OPPENHEIM ALAN S. WILLSKY WITH S. HAMID NAWAB	Prentice- hall signal processing Series	2nd edition
Reference Books				
1	Higher Engineering Mathematics	B. V. Ramana	Tata McGraw-Hill	11th Edition. 2010
2	Calculus	George. B. Thomas	Pearsons edn. Inc	13th Edition. 2014
3	A Text book of Engineering Mathematics	N. P. Bali and Manish Goyal	Laxmi Publications	Latest edition

Semester: III
Course Name: Basic Signal Processing

Course Code	21EC32	CIE Marks	50
Teaching Hours / Week (L:T:P)	3:0:2	SEE Marks	50
Total Hours of Pedagogy	40(T)+20(P)	Total Marks	100
Credits	04	Exam Hours	03

Pre-requisites: Basics of Mathematics-Fourier series, Partial fractions.

Module-1

Introduction and Classification of signals: Definition of signal and systems with examples, Elementary signals / Functions: Exponential, sinusoidal, step, impulse and ramp functions **Basic Operations on signals:** Amplitude scaling, addition, multiplication, time scaling, time shift and time reversal. Expression of triangular, rectangular and other waveforms in terms of elementary signals **Classification of Systems and properties:** Linear-nonlinear, Time variant -invariant, causal-non causal, static-dynamic, stable-unstable, invertible-non invertible. **(Text 1, Chapter 1: 1. 1 to 1. 8)** **8 Hours**
Self-Study topics: Plotting of basic signals and operations on signals with properties.

Module-2

Time domain representation of LTI System: Impulse response, convolution sum and integral. Computation of convolution sum using graphical method for unit step and unit step, unit step and exponential, exponential and exponential, unit step and rectangular, and rectangular and rectangular signals. **LTI system Properties in terms of impulse response:** System interconnection, Memory less, Causal, Stable, Invertible and Deconvolution and step response. **(Text 1, Chapter 2: 2. 1 to 2. 9)** **8 Hours**
Self-Study topics: Applications of LTI Systems

Module-3

Continuous Time Fourier Transform: Fourier Transform of periodic / aperiodic signals, Properties of CTFT: Linearity, time shifting, conjugation and conjugate symmetry, differentiation and integration, time and frequency scaling, duality, Parseval's relation, convolution and modulation theorem **(Text 2, Chapter 4:4. 1 to 4. 5)** **8 Hours**
Self-Study topics: Verification of properties

Module-4

Discrete Time Fourier Transform: Fourier analysis of discrete time Signals and systems, DTFT, Properties of DTFT -periodicity, linearity, time and frequency shifting, conjugate symmetry, time reversal **(Text 2, Chapter 5: 5. 1 to 5. 3)** **8 Hours**
Self-Study topics: Verification of properties

Module-5

The Z-Transforms: Z transform, unilateral, Initial conditions, properties of the region of convergence, properties of the Z-transform, Inverse Z-transform by partial fraction, Causality and stability, Transform analysis of LTI systems. **(Text 1, Chapter 6: 6. 1 to 6. 10)** **8 Hours**
Self-Study topics: Solving Z-Transforms by partial fractions

PRACTICAL COMPONENT OF IPCC

SN	Experiments
1	Generation and plotting of Continuous and Discrete Signals ex: unit step, unit ramp, sinusoidal, exponential, square, pulse, saw tooth, Sinc Signals (Any arbitrary Signals)
2	To verify different Properties of given System. a)Causal and no causal Systems b)Static and dynamic systems c)Linear and nonlinear Systems d)Time-Invariant and variant systems
3	Different mathematical Operations on Continuous and discrete time signals a)Addition of two signals b)Even and odd component Signals c) amplitude scaling and Time shifting
4	Convolution of CT and DT signals
5	To find Fourier transform of a given signal and plot its magnitude and phase spectrum
6	To find impulse response of LTI System and locate the zeros and poles, plot the zero-pole maps in Z plane
7	Transformation of signals into time and frequency domain

8	Modulation of Signals
9	Noise reduction in Communication systems
10	Synthesizing the Sound of a plucked String
11	Impulse Response and distortion removal

Course Outcomes:

1. **Perform** mathematical operations on a given continuous / discrete type signal and Classify systems based on their properties.
2. **Develop** input output relationship for a given LTI system and analyze the LTI system properties.
3. **Apply** Fourier transform to the continuous and discrete time signals and analyze their properties.
4. **Analyze** the discrete time signals and LTI systems applying Z transforms.
5. **Demonstrate** the solution for a given open ended problem / Mini-lab project through simulation / emulation in the field of signal processing.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author / s	Name of the Publisher	Edition and Year
Textbooks				
1	Signals and Systems	Simon Haykin	Wiley India	2nd Edition & 2008
2	Signals and Systems	Alan V. Oppenheim, Alan S, Wilsky with Hamid Nawab	PHI Publications	2nd Edition & 2011
Reference Books				
1	Fundamentals of Signals & Systems	Michael Roberts	Tata McGraw Hill Education(India), Private Limited	2nd edition
2	Signals and Systems	H P Hsu, R Ranjan	Schaum's Outlines	TMH 2006

Semester: III
Course Name: Digital Circuit Design Using Verilog

Course Code	21EC33	CIE Marks	50
Teaching Hours / Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Pre-requisites: Number systems, Arithmetic and Logical operations, Basic gates.

Module-1

Principles of Combinational Logic: Definition of combinational logic, Problem statements to truth tables, Deriving switching equations, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps, Three and four variables Karnaugh maps, Incompletely specified Functions(Don't care Terms), Simplifying Maxterm Equations, Map entered variables, Multiple output functions.

Text1: 3. 1, 3. 1. 1, 3. 1. 2, 3. 2, 3. 3, 3. 4, 3. 4. 1, 3. 4. 5, 3. 4. 6, 3. 6 & 3. 8 **8 Hours**

Self-study topics: Hazards in combinational circuits, Quine-McCluskey Minimization Technique, Quine-McCluskey using Don't Care Terms.

Module-2

Overview of digital design with Verilog HDL: Typical HDL flow, Importance of HDLs.
Hierarchical Modeling concepts: Design methodologies, Modules.
Verilog basic concepts: Lexical conventions, data types.
Modules and ports: Module definition, port declaration, port connection rules.
Gate level modeling: Gate types, AND / OR gates, BUF / NOT gates, Examples like 4-bit ripple carry full adder.

Text 2: 1. 3, 1. 4, 2. 1, 2. 3, 3. 1, 3. 2, 4. 1, 4. 2. 2, 4. 2. 3, 5. 1, 5. 1. 1, 5. 1. 2, 5. 1. 4 **6 Hours**

Self-study topics: Popularity of Verilog HDL, Components of a simulation, Half Adder & full adder using gate level modeling.

Module-3

Analysis and Design of Combinational Logic: Introduction to Digital Integrated circuits, Decoders, BCD Decoder, Encoders, Digital Multiplexers, Using multiplexer as Boolean Function generators, Adders and Subtractors, Cascading full adders, Look ahead carry, Binary Comparator (1 bit, 2-bit comparators only), Tri-state buffers.

Text1: 4. 2, 4. 3, 4. 3. 1, 4. 4, 4. 5, 4. 5. 1, 4. 6, 4. 6. 1, 4. 6. 2, 4. 7, 4. 10 **8 Hours**

Self-study topics: Adders types, role of decoder in processor, ALU and Array Multipliers.

Module-4

Sequential circuits: Sequential circuit models (universal model only), Flip-flops: flip-flop logic symbols, function and triggering, Latches, J-K Clocked flip-flops, clocked T&D flip-flop, Master-slave flip-flops, Edge triggered flip-flops, Flip Flop timing specifications.
Simple counters: Divide by 2, 4, and 8 counters (Asynchronous), Mod-8 synchronous counter. Registers: Register Data input and output, Parallel input / Parallel output, Serial input / serial output shift registers.
Finite State Machines: Mealy sequential circuit design, Design of Moore sequential Circuit, Equivalent States and Reduction of State Tables.

Text1: 5. 1, 5. 2, 5. 3, 5. 4, 5. 6, 5. 6. 1, 6. 1, 6. 2, 6. 2. 1, 6. 2. 2, 6. 5
Text3: 1. 7, 1. 8, 1. 9 **10 Hours**

Self-study topics: Johnson counter (Synchronous), Ring counter (synchronous), Up-Down Decade counter design, Difference between Moore and Mealy models,

Module-5

Data Flow Modeling: Expressions, Operators and operands, operator types, Examples such as 4to1 multiplexer, 4-bit full adder.
Behavioral Modeling: Structured procedures, Procedural assignments, Delay based timing control, Multiway branching, loops, Examples -Only Verilog Description

Text 2: 6. 3, 6. 4, 6. 5, 6. 5. 1, 6. 5. 2, 7. 1, 7. 2, 7. 3. 1, 7. 5, 7. 6, 7. 9. **8 Hours**

Self-study topics: Logic synthesis with Verilog

Course Outcomes:

1. **Use** Karnaugh map and Quine-McCluskey minimization methods to simplify the given digital circuits.
2. **Explore** the applications of combinational logic circuits such as Decoder, Encoder, Multiplexer, Adder, Subtractor etc. to realize the given Boolean function.
3. **Explore** the applications of sequential logic circuits and their machine models to design digital circuits.
4. **Realize** the given digital circuits using structural, data flow and behavioral verilog HDL modeling styles with appropriate design approaches.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author / s	Name of the Publisher	Edition and Year
Textbooks				
1	Digital Logic Applications and Design.	John M Yarbrough	Cengage Learning	2008 (reprint)
2	Verilog HDL: A Guide to Digital Design and Synthesis.	Samir Palnitkar	Pearson Education	2^{nd} Edition
3	Fundamentals of Logic Design.	Charles H. Roth (Jr.)	West publications	4^{th} Edition, 1992
Reference Books				
1	Modern Digital Electronics	R P Jain	Tata McGraw-Hill.	3^{rd} Edition
2	Digital Principle and Design.	Donald D. Givone	McGraw-Hill	2003
3	HDL Programming VHDL and Verilog	Nazeih M Botros	Dreamtech press	2009

Semester: III
Course Name: Analog Electronic Circuits

Course Code	21EC34	CIE Marks	50
Teaching Hours / Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Pre-requisites: Semiconductor Physics, Electronic Devices

Module-1

Introduction to Electronic Devices
Diode & its Applications: Introduction, pn-Junction Diode, Equivalent Circuit of Diode, Half Wave & Full Wave Rectification(With Derivation of Efficiency & Ripple Factor), Wave Shaping Circuits-Clipping, Clamping
Voltage Regulators: Fixed Voltage Regulators and Adjustable Voltage Regulators
BJT: Introduction, BJT Construction and Operation, BJT Configuration and characteristics
FET: Introduction to FET, Construction, operation, Characteristics of MOSFET

Text 1: 2. 1, 2. 2, 2. 2. 3, 2. 4, 2. 5. 1, 2. 5. 2, 2. 5. 4, 2. 5. 5, 3. 1, 3. 2, 3. 3, 4. 1, 4. 3 Text 3: 9. 7. 1, 9. 7. 2
8 Hours

Self-Study Topics: BJT as Switch & as Amplifier

Module-2

BJT Biasing: Biasing in BJT amplifier circuits: The Classical Discrete circuit bias (Voltage-divider bias), Biasing using a collector to base feedback resistor.
BJT Small signal operation and Modeling: Collector current and transconductance, Base current and input resistance at the base, Emitter current and input resistance at the emitter, voltage gain, Separating the signal and the DC quantities, The hybrid Π model, The T model.
MOSFETs Biasing: Biasing in MOS amplifier circuits: Biasing by Fixing V_{GS}, Biasing by Fixing V_G and Biasing using a Drain to Gate feedback resistor.
MOSFET Small signal operation and Modeling: The DC bias point, signal current in drain terminal, voltage gain, Separating the DC Analysis and the signal analysis, small signal equivalent circuit models, Transconductance, The T equivalent circuit model.

Text 2: 3. 5(3. 5. 1, 3. 5. 3), 3. 6(3. 6. 1 to 3. 6. 7), 4. 5(4. 5. 1, 4. 5. 2, 4. 5. 3), 4. 6(4. 6. 1 to 4. 6. 7) **8 Hours**

Self-Study Topics: Large Signal Modeling for BJT

Module-3

MOSFET Amplifier configuration: Basic Structure, characterizing amplifiers, CS amplifier with and without source resistance R_S, Source follower amplifier.
MOSFET internal capacitances and High frequency model: The gate capacitive effect, Junction capacitances, High frequency MOSFET model.
Frequency response of the CS amplifier: The three frequency bands, high frequency response, Low frequency response.
IC Biasing: Current Sources, Current Mirrors and Current Steering Circuits.
Text 2: 4. 7 (4. 7. 1 to 4. 7. 4, 4. 7. 6), 4. 8(4. 8. 1, 4. 8. 2, 4. 8. 3), 4. 9(4. 9. 1, 4. 9. 2, 4. 9. 3), 6. 3(6. 3. 1, 6. 3. 2)
8 Hours

Self-Study Topics: Large Signal Modeling for MOSFET

Module-4

Feedback Amplifier: General feedback structure, Properties of negative feedback, The Four Basic Feedback Topologies, The series-shunt Feedback amplifier, series-series Feedback amplifier, shunt-shunt and shunt-series Feedback amplifiers (Qualitative Analysis).
Power Amplifiers: Introduction, Classification of output stages, Class A and Class B output stage: Transfer Characteristics, Power Dissipation, Power Conversion efficiency, Class AB output stage: Circuit operation, output resistance, Class C Output Stage: Efficiency.
Text 2: 7. 1, 7. 2, 7. 3, 7. 4. 1, 7. 5. 1, 7. 6 (7. 6. 1 to 7. 6. 3), 12. 1, 12. 2 (12. 2. 1, 12. 2. 3, 12. 2. 4), 12. 3 (12. 3. 2, 12. 3. 3, 12. 3. 4), 12. 4, 12. 6 **8 Hours**

Self-Study Topics: Class D Power Amplifier

Module-5

Op-Amp Applications: Instrumentation Amplifier, Peak detector, DAC-Weighted resistor and R-2R ladder, ADC-Successive approximation type, Active Filters- First and second order low-pass and high-pass Butterworth filters, Band-pass filters, Band reject filters. **IC 555 Timers and its Operating modes:** Introduction, Monostable and Astable Multivibrators. **Text 3:** 6. 6, 8. 11(8. 11. 1(a), 8. 11. 1(b), 8. 11. 2(a), 8. 14, 7. 2-7. 6, 7. 8, 7. 9, 9. 4 **8 Hours**
Self-Study Topics: Waveform generators using 555 Timer.

Course Outcomes:

After studying this course, students will be able to:

1. **Outline** the Construction, operation & characteristics of Junction & Field Effect devices
2. **Design** and **analyze** BJT and FET amplifiers with different circuit configurations and biasing conditions.
3. **Apply** the concepts of feedback topologies in the design of amplifiers and oscillators.
4. **Explore** the wide range applications of linear ICs such as ADC, DAC, filters and timers.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author / s	Name of the Publisher	Edition and Year
Textbooks				
1.	Basic Electronics	D. P Kothari & I J Nagrath	McGraw Hill Education (India) Pvt. Limited,	2014, ISBN: 978-93-329-0158-2,
2	"Micro Electronic Circuits Theory and Application"	Adel S. Sedra and Kenneth C. Smith,	Oxford University Press	5th Edition, 2013, ISBN-10:978-0-19-806225-7
3	"Op-Amps and Linear Integrated Circuits"	Ramakant A Gayakwad	Pearson Education	4th Edition, 2018. ISBN: 978-93-325-4991-3
Reference Books				
1	"Electronics devices and Circuit theory"	Robert L. Boylestad and Louis Nashelsky	PearsonEducation	10th / 11th Edition, 2012, ISBN:978-81-317-6459-6.
2	"Integrated Electronics Analog and Digital Circuits and Systems"	J. Millman&C. C. Halkias	McGraw Hill Education (India) Pvt. Limited,	2nd edition, 2010, ISBN 0- 07-462245-5

Semester: III
Name of the Laboratory: Digital Circuit Design Laboratory

Course Code	21ECL35	CIE Marks	50
Teaching Hours / Week (L:T:P)	0:0:2	SEE Marks	50
Total Hours of Pedagogy	20	Total Marks	100
Credits	01	Exam Hours	03

Pre-requisites: Number systems, Arithmetic and Logical operations, Basic gates.

List of Experiments

SN	Experiments
Prerequisites: To verify i) The SOP and POS expressions using universal gates. ii) De- Morgan's theorem for 2 variables.	

Part - A

The following experiments can be done using Digital IC Trainer Kit	
1	Design and implement i) Half adder and Full adder using NAND gates. ii) Full subtractor using NAND gates. iii) 4-bit parallel adder using IC7483.
2	Design and implement i) Simplified 4 variable function using basic gates by applying Boolean rules and K-map. ii) 4 variable function using IC74151 (8:1MUX).
3	Realize i) SR Flip Flop ii) D Flip Flop iii) Master and slave JK Flip Flop iv) T Flip Flop
4	i) Realize shift register using IC 7495. a. SISO b. SIPO c. PISO d. PIPO ii) Realize Mod-n synchronous counter using IC74192. iii) Realize Mod-n asynchronous counter using IC7490.
5	Design and implement 3 bit sequence detector to detect given sequence.

Part B

The following experiments can be done using Xilinx / Mentor Graphics or any other equivalent EDA tools	
1	Write a Verilog code to describe the functions of a Full Adder using three modeling styles
2	Write a Verilog Code to i) Design 8:3 Encoders with and without Priority. ii) Design 2:1 Multiplexer using Conditional Operator.
3	Design a Mod-n counters (Synchronous reset and Asynchronous reset) using Verilog code.
4	Design Mealy FSM model to detect the given sequence with / without overlap using verilog.

Part C

Demonstration Experiments / Open ended Experiments	
1	Write a Verilog code to interface DAC unit to the FPGA / CPLD for square and triangular waveform generation.
2	Write Verilog code to interface a 7-segment display to the FPGA / CPLD.
3	Any Open ended experiments / Mini Lab Projects

Course outcomes:

1. **Design** and **realize** the combinational logic circuits such as adders, subtractors, comparators etc. as per the given specifications.
2. **Design** and **realize** the sequential logic circuits such as Flip flops, registers etc. as per the given specifications.
3. **Utilize** Verilog constructs as per the IEEE 1364-2001 Verilog standard to design and verify the digital circuits for the given specifications.
4. **Demonstrate** the solutions for the given open ended problem / Mini lab projects in the area of digital circuit design.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author / s	Name of the Publisher	Edition and Year
Textbooks				
1	Digital Logic Applications and Design.	John M Yarbrough	Thomson Learning	2008 (reprint)
2	Verilog HDL: A Guide to Digital Design and Synthesis.	Samir Palnitkar	Pearson Education	2nd Edition
Reference Books:				
1	Fundamentals of Logic Design.	Charles H. Roth (Jr.)	West publications	4th Edition, 1992
2	Modern Digital Electronics	R P Jain	Tata McGraw-Hill.	3rd Edition
3	Digital Principle and Design.	Donald D. Givone	McGraw-Hill	2003
4	HDL Programming VHDL and Verilog	Nazeih M Botros	Dreamtech press	2009

Semester: III
Name of the Laboratory: Analog Electronic Circuits Laboratory

Course Code	21ECL36	CIE Marks	50
Teaching Hours / Week (L:T:P)	0:0:2	SEE Marks	50
Total Hours of Pedagogy	20	Total Marks	100
Credits	01	Exam Hours	03

Pre-requisites: Semiconductor Physics, Electronic Devices

List of Experiments

SN	Part-A Experiments using Discrete components
1	Design and set up the following rectifiers with and without filters and determine ripple factor and efficiency: (a)Full Wave Rectifier (b) Bridge Rectifier
2	Conduct experiment to test diode clipping (single / double ended) and clamping circuits (positive / negative) for given specifications.
3	Design and set up the BJT common emitter amplifier using voltage divider bias with and without feedback and determine the gain- bandwidth product from its frequency response
4	Design and set-up the crystal oscillator and determine the frequency of oscillation.
5	Design Adder, Integrator and Differentiator circuits using Op-Amp
6	Test a comparator circuit and design a Schmitt trigger for the given UTP and LTP values and obtain the hysteresis
7	Design Astable Multivibrator using 555 Timer for given specifications
8	Design 4-bit R-2R DAC using Op-Amp
	Part-B Simulation using EDA software (p-spice, Multisim or any Equivalent tool)
1	Design and Simulate the RC-Phase shift Oscillator using Op-Amp, and Verify the frequency of Oscillations
2	Design and Simulate the Monostable Multivibrator using 555 Timer for given specifications
3	Simulate the transfer and drain characteristics of a MOSFET and calculate its drain resistance, mutual conductance and amplification factor
4	Simulate Current Mirror Circuits using MOSFET
Part-C Open-Ended Experiments / Mini Lab Projects	
Any Open-Ended Experiments / Mini Lab Projects	

Course Outcomes:

At the end of this laboratory course, the students will be able to:

1. **Implement** circuits of rectifiers, clipping circuits, clamping circuits for a given specifications
2. **Analyze** the characteristics of BJT / MOSFET in the design of amplifiers and current mirrors
3. **Design** analog circuits using OPAMPs and 555 timer for different applications
4. **Demonstrate** the solutions for the given open ended problem / Mini lab projects applying Analog circuit design principles

Suggested Learning Resources:

SN	Title of the Book	Name of the Author / s	Name of the Publisher	Edition and Year
1.	“Basic Electronics”	D. P Kothari & I J Nagrath	McGraw Hill Education (India) Pvt. Limited,	2014, ISBN: 978-93-329-0158-2,
2	“Micro Electronic Circuits Theory and Application”	Adel S. Sedra and Kenneth C. Smith,	Oxford University Press	5th Edition, 2013, ISBN-10:978-0-19-806225-7
3	“Op-Amps and Linear Integrated Circuits”	Ramakant A Gayakwad	Pearson Education	4th Edition, 2018. ISBN: 978-93-325-4991-3
Reference Books:				
1	"Electronics Lab Manual"	Navas K A,	PHI Learning Pvt. Ltd.	2018

Semester: III / IV (Common to All)

ಬಳಕೆ ಕನ್ನಡ – Balake Kannada (Kannada for Usage)

ಕನ್ನಡ ಕಲಿಕೆಗಾಗಿ ನಿಗಡಿಪಡಿಸಿದ ಪಠ್ಯಪುಸ್ತಕ - (Prescribed Textbook to Learn Kannada)

ವಿಷಯ ಸಂಕೇತ (Course Code)	21KSK37/47	ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನದ ಅಂಕಗಳು (Continuous Internal Evaluation Marks)	100
ಒಂದು ವಾರಕ್ಕೆ ಬೋಧನಾ ಅವಧಿ (Teaching Hours / Week (L:T:P)	1-0-0		
ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ Total Hours of Pedagogy	15 ಗಂಟೆಗಳು	ಒಟ್ಟು ಅಂಕಗಳು (Total Marks)	100
PÉærmïi (Credits)	01	ಪರೀಕ್ಷೆಯ ಅವಧಿ (Exam Hours)	02 ಗಂಟೆ

ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು: (Course Learning Objectives):

- To create the awareness regarding the necessity of learning local language for comfortable and healthy life.
- To enable learners to Listen and understand the Kannada language properly.
- To speak, read and write Kannada language as per requirement.
- To train the learners for correct and polite conservation.

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ (Teaching-Learning Process - General Instructions) :

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. ಬಳಕೆ ಕನ್ನಡವನ್ನು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಬೋಧಿಸಲು ವಿಟಿಯು ಸೂಚಿಸಿರುವ ಪಠ್ಯಪುಸ್ತಕಗಳನ್ನು ಉಪಯೋಗಿಸಬೇಕು.
2. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಉತ್ತೇಜಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು.
3. ಪ್ರತಿ ವಿದ್ಯಾರ್ಥಿ ಪುಸ್ತಕವನ್ನು ತರಗತಿಯಲ್ಲಿ ಬಳಸುವಂತೆ ನೋಡಿಕೊಳ್ಳುವುದು ಮತ್ತು ಪ್ರತಿ ಪಾಠ ಮತ್ತು ಪ್ರವಚನಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧಪಟ್ಟಂತೆ ಪೂರಕ ಚಟುವಟಿಕೆಗಳಿಗೆ ತೊಡಗಿಸತಕ್ಕದ್ದು.

1. ಡಿಜಿಟಲ್ ತಂತ್ರಜ್ಞಾನದ ಮುಖಾಂತರ ಇತ್ತೀಚಿಗೆ ಡಿಜಿಟಲೀಕರಣಗೊಂಡಿರುವ ಭಾಷೆ ಕಲಿಕೆಯ ವಿಧಾನಗಳನ್ನು ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ಮುಖಾಂತರ ಚರ್ಚಿಸಲು ಕ್ರಮಕೈಗೊಳ್ಳುವುದು. ಇದರಿಂದ ವಿದ್ಯಾಥಿಗಳನ್ನು ತರಗತಿಯಲ್ಲಿ ಹೆಚ್ಚು ಏಕಾಗ್ರತೆಯಿಂದ ಪಾಠ ಕೇಳಲು ಮತ್ತು ಅಧ್ಯಯನದಲ್ಲಿ ತೊಡಗಲು ಅನುಕೂಲವಾಗುತ್ತದೆ.
2. ಭಾಷಾಕಲಿಕೆಯ ಪ್ರಯೋಗಾಲಯದ ಮುಖಾಂತರ ಬಹುಬೇಗ ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಕಲಿಯಲು ಅನುಕೂಲವಾಗುವಂತೆ ಕಾಯಚಟುವಟಿಕೆಗಳನ್ನು ಮತ್ತು ಕ್ರಿಯಾ ಯೋಜನೆಗಳನ್ನು ರೂಪಿಸುವುದು.

Module-1

1. Introduction, Necessity of learning a local language. Methods to learn the Kannada language.
2. Easy learning of a Kannada Language: A few tips. Hints for correct and polite conservation, Listening and Speaking Activities
3. Key to Transcription.
4. ವೈಯುಕ್ತಿಕ, ಸ್ವಾಮ್ಯಸೂಚಕ / ಸಂಬಂಧಿತ ಸಾರ್ವನಾಮಗಳು ಮತ್ತು ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು – Personal Pronouns, Possessive Forms, Interrogative words

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ:

ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

Module-2

1. ನಾಮಪದಗಳು ಸಂಬಂಧಾರ್ಥಕ ರೂಪಗಳು, ಸಂದೇಹಾಸ್ಪದ ಪ್ರಶ್ನೆಗಳು ಮತ್ತು ಸಂಬಂಧವಾಚಕ ನಾಮಪದಗಳು – Possessive forms of nouns, dubitative question and Relative nouns
2. ಗುಣ, ಪರಿಮಾಣ ಮತ್ತು ವರ್ಣಬಣ್ಣ ವಿಶೇಷಣಗಳು, ಸಂಖ್ಯಾವಾಚಕಗಳು Qualitative, Quantitative and Colour Adjectives, Numerals
3. ಕಾರಕ ರೂಪಗಳು ಮತ್ತು ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು – ಸಪ್ತಮಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯ – (ಆ, ಅದು, ಅವು, ಅಲ್ಲಿ) Predictive Forms, Locative Case

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ:

ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

Module-3

1. ಚತುರ್ಥಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯದ ಬಳಕೆ ಮತ್ತು ಸಂಖ್ಯಾವಾಚಕಗಳು – Dative Cases and Numerals
2. ಸಂಖ್ಯಾಗುಣವಾಚಕಗಳು ಮತ್ತು ಬಹುವಚನ ನಾಮರೂಪಗಳು – Ordinal Numerals and Plural markers.
3. ನ್ಯೂನ / ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾಪದಗಳು ಮತ್ತು ವರ್ಣ ಗುಣವಾಚಕಗಳು – Defective / Negative Verbs and Colour Adjectives.

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ:

ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

Module-4

1. ಅಪ್ಪಣೆ / ಒಪ್ಪಿಗೆ, ನಿರ್ದೇಶನ, ಪ್ರೋತ್ಸಾಹ ಮತ್ತು ಒತ್ತಾಯ ಅರ್ಥರೂಪ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು Permission, Commands, Encouraging and Urging words (Imperative words and sentences).
2. ಸಾಮಾನ್ಯ ಸಂಭಾಷಣೆಗಳಲ್ಲಿ ದ್ವಿತೀಯ ವಿಭಕ್ತಿ ಪ್ರತ್ಯೇಯಗಳು ಮತ್ತು ಸಂಭವನೀಯ ಪ್ರಕಾರಗಳು Accusative Cases and Potential Forms used in General Communication.
3. "ಇರು ಮತ್ತು ಇರಲ್ಲ" ಸಹಯಕ ಕ್ರಿಯಾಪದಗಳು, ಸಂಭಾವ್ಯಸೂಚಕ ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯ ಪದಗಳು. - Helping Verbs "iru and iralla", Corresponding Future and Negation Verbs.
4. ಹೋಲಿಕೆ (ತರತಮ), ಸಂಬಂಧ ಸೂಚಕ ಮತ್ತು ವಸ್ತು ಸೂಚಕ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಪದಗಳ ಬಳಕೆ. Comparative, Relationship, Identification and Negation Words

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ:

ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

Module-5

1. ಕಾಲ ಮತ್ತು ಸಮಯದ ಹಾಗೂ ಕ್ರಿಯಾಪದಗಳ ವಿವಿಧ ಪ್ರಕಾರಗಳು – different types of forms of Tense, Time and Verbs
2. ದ್, –ತ್, –ತು, –ಇತು, –ಆಗಿ, –ಅಲ್ಲ, –ಗ್, –ಕ್, ಇದೆ, ಕ್ರಿಯ ಪ್ರತ್ಯಯಗಳೊಂದಿಗೆ ಭೂತ, ಭವಿಷ್ಯತ್ ಮತ್ತು ವರ್ತಮಾನ ಕಾಲ ವಾಕ್ಯ ರಚನೆ Formation of Past, Future and Present Tense Sentences with Verb Forms
3. Kannada Vocabulary List : ಸಂಭಾಷಣೆಯಲ್ಲಿ ದಿನೋಪಯೋಗಿ ಕನ್ನಡ ಪದಗಳು – Kannada Words in Conversation

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ:

ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವ ಅನುಕೂಲಗಳು ಮತ್ತು ಫಲಿತಾಂಶಗಳು:

Skill Set: At the end of the Course, The Students will be able

1. To understand the necessity of learning of local language for comfortable life.
2. To Listen and understand the Kannada language properly.
3. To speak, read and write Kannada language as per requirement.
4. To communicate (converse) in Kannada language in their daily life with Kannada speakers.
5. To speak in polite conservation.

Textbook:

ಬಳಕೆ ಕನ್ನಡ

ಲೇಖಕರು: ಡಾ. ಎಲ್.ತಿಮ್ಮೇಶ

ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

Semester: III / IV (Common to all)
ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ

ವಿಷಯ ಸಂಕೇತ (Course Code)	21KSK37/47	ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನದ ಅಂಕಗಳು	100
ಒಂದು ವಾರಕ್ಕೆ ಬೋಧನಾ ಅವಧಿ (Teaching Hours / Week (L:T:P:S)	1-0-0		
ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ Total Hours of Pedagogy	15 ಗಂಟೆಗಳು	ಒಟ್ಟು ಅಂಕಗಳು	100
ಕ್ರೆಡಿಟ್ಸ್ (Credits)	01	ಪರೀಕ್ಷೆಯ ಅವಧಿ	02 ಗಂಟೆ

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

1. ವೃತ್ತಿಪರ ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
2. ಕನ್ನಡ ಸಾಹಿತ್ಯಯದ ಪ್ರಧಾನ ಭಾಗವಾದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳನ್ನು ಸಾಂಕೇತಿಕವಾಗಿ ಪರಿಚಯಿಸಿ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಅರಿವು ಹಾಗೂ ಅವರುಗಳ ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
3. ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವನ್ನು ಹಾಗೂ ಅವರುಗಳು ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
4. ಕನ್ನಡ ಶಬ್ದ ಸಂಪತ್ತಿನ ಪರಿಚಯ ಮತ್ತು ಕನ್ನಡ ಭಾಷೆಯ ಬಳಕೆ ಹಾಗೂ ಕನ್ನಡದಲ್ಲಿ ಪತ್ರ ವ್ಯವಹಾರವನ್ನು ತಿಳಿಸಿಕೊಡುವುದು.

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ
(Teaching-Learning Process - General Instructions):
These are sample Strategies, which teacher can use to accelerate the attainment of the course outcomes.

1. ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡವನ್ನು ಬೋಧಿಸಲು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಪ್ರಸ್ತುತ ಪುಸ್ತಕ ಆಧಾರಿಸಿ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನವನ್ನು ಅನುಸರಿಸುವುದು. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಪ್ರೇರೇಪಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು.
2. ಇತ್ತೀಚಿನ ತಂತ್ರಜ್ಞಾನದ ಅನುಕೂಲಗಳನ್ನು ಬಳಸಿಕೊಳ್ಳುವುದು – ಅಂದರೆ ಕವಿ–ಕಾವ್ಯ ಪರಿಚಯದಲ್ಲಿ ಕವಿಗಳ ಚಿತ್ರಣ ಮತ್ತು ಲೇಖನಗಳು ಮತ್ತು ಕಥೆ ಕಾವ್ಯಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧಪಟ್ಟ ಧ್ವನಿ ಚಿತ್ರಗಳು, ಸಂಭಾಷಣೆಗಳು, ಈಗಾಗಲೇ ಇತರ ವಿಮರ್ಶಕರು ಬರೆದಿರುವ ವಿಮರ್ಶಾತ್ಮಕ ವಿಷಯಗಳನ್ನು ಪಿಪಿಟಿ, ಡಿಜಿಟಲ್ ಮಾಧ್ಯಗಳ ಮುಖಾಂತರ ವಿಶ್ಲೇಷಿಸುವುದು.
3. ನವೀನ ಮಾದರಿಯ ಸಾಹಿತ್ಯ ಬೋಧನೆಗೆ ಸಂಬಂಧಪಟ್ಟ ವಿಧಾನಗಳನ್ನು ಶಿಕ್ಷಕರು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಅನುಕೂಲವಾಗುವ ರೀತಿಯಲ್ಲಿ ಅಳವಡಿಸಿಕೊಳ್ಳಬಹುದು.

ಘಟಕ–1 ಲೇಖನಗಳು

1. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ – ಹಂಪ ನಾಗರಾಜಯ್ಯ
2. ಕರ್ನಾಟಕದ ಏಕೀಕರಣ : ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ – ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ
3. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ – ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ ಮತ್ತು ಪ್ರೊ. ವಿ.ಕೇಶವಮೂರ್ತಿ

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ:
ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

ಘಟಕ–2 ಆಧುನಿಕ ಪೂರ್ವದ ಕಾವ್ಯ ಭಾಗ

1. **ವಚನಗಳು:** ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಆಯ್ದಕ್ಕಿ ಮಾರಯ್ಯ, ಜೇಡರದಾಸಿಮಯ್ಯ, ಆಯ್ದಕ್ಕಿ ಲಕ್ಕಮ್ಮ,
2. **ಕೀರ್ತನೆಗಳು:** ಅದರಿಂದೇನು ಫಲ ಇದರಿಂದೇನು ಫಲ – ಪುರಂದರದಾಸರು
   ತಲ್ಲಣಿಸದಿರು ಕಂಡ್ಯ ತಾಳು ಮನವೇ – ಕನಕದಾಸರು
3. **ತತ್ವಪದಗಳು:** ಸಾವಿರ ಕೊಡಗಳ ಸುಟ್ಟು – ಶಿಶುನಾಳ ಶರೀಫ

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ:
ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

ಘಟಕ–3 ಆಧುನಿಕ ಕಾವ್ಯಭಾಗ

1. ಡಿವಿಜಿ ರವರ ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗದಿಂದ ಆಯ್ದ ಕೆಲವು ಭಾಗಗಳು
2. ಕುರುಡು ಕಾಂಚಾಣ : ದಾ.ರಾ. ಬೇಂದ್ರೆ
3. ಹೊಸಬಾಳಿನ ಗೀತೆ : ಕುವೆಂಪು

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ:

ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

ಘಟಕ–4 ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ

1. ಡಾ. ಸರ್.ಎಂ. ವಿಶ್ವೇಶ್ವರಯ್ಯ : ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ – ಎ ಎನ್ ಮೂರ್ತಿರಾವ್
2. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ – ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ:

ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

ಘಟಕ–5 ಕಥೆ ಮತ್ತು ಪ್ರವಾಸ ಕಥನ

1. ಯುಗಾದಿ : ವಸುಧೇಂದ್ರ
2. ಮೇಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ : ಹಿ.ಚಿ. ಬೋರಲಿಂಗಯ್ಯ

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ:

ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವು ಪರಿಣಾಮಗಳು: (Course Outcomes):

1. ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯವಾಗುತ್ತದೆ.
2. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಆಸಕ್ತಿಯು ಮೂಡುತ್ತದೆ.
3. ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ.
4. ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ, ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ.

ಪಠ್ಯಪುಸ್ತಕ:
ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ
ಡಾ. ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯ ಮತ್ತು ಡಾ. ಎಲ್.ತಿಮ್ಮೇಶ
ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

Semester: III / IV
Course Name: CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND CYBER LAW

Course Code	21CIP37/47	CIE Marks	50
Teaching Hours/Week (L:T:P)	1:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	1	Exam Hours	02

Module – 1

Introduction to Indian Constitution
The Making of the Constitution, The Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India. Fundamental Rights. Directive Principles of State Policy (DPSP). Fundamental Duties.
3 Hours

Module - 2

Union Executive and State Executive:
Parliamentary System, Federal System, Union Executive – President, Prime Minister, Union Cabinet, Parliament – Union Legislature, Lok Sabha and Rajya Sabha types of bills. Union judiciary Supreme Court of India. **3 Hours**

Module – 3

Elections, Amendments and Emergency Provisions
Elections, Electoral Process, and Election Commission of India, Election Laws. Amendments - Methods in Constitutional Amendments. Important Constitutional Amendments. Amendments – 7, 9, 10, 12, 42, 44, 61, 73, 74, 75, 86, and 91, 94, 95, 100, 101, 118. Emergency Provisions, types of Emergencies and its consequences. Special Provisions (Articles 370.371,371J) for some States **3 Hours**

Module – 4

Professional / Engineering Ethis:
Scope & Aims of Engineering & Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Role morality. What is profession characteristic of profession? The NSPE board of Professional ethics. Engineering ethics as preventive ethics. Responsible Engineer. Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. What is conflict of interest? Honesty integrity and reliability. IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering. **3 Hours**

Module – 5

Internet Laws, Cyber Crimes and Cyber Laws:
Internet and Need for Cyber Laws, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000. Cybercrimes and enforcement agencies. **3 Hours**

Course Outcomes:
1. Have constitutional knowledge and legal literacy.
2. Understand Engineering and Professional ethics and responsibilities of Engineers
3. Understand the cybercrimes and cyber laws for cyber safety measures

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Constitution of India, Professional Ethics and Human Rights	Shubham Singles, Charles E. Haries, and et al	Cengage Learning India	2018
2	Cyber Security and Cyber Laws	Alfred Basta and et al	Cengage Learning India	2018
3	Introduction to the Constitution of India	Durga Das Basu	Prentice –Hall	2008
4	Engineering Ethics	M. Govindarajan, S. Natarajan, V. S. Senthilkumar	Prentice –Hall	2004

Semester: III
Name of the Course: Programming with Hardware Controllers

Course Code	21AEC38	CIE Marks	50
Teaching Hours / Week (L:T:P)	0:0:2	SEE Marks	50
Total Hours of Pedagogy	20	Total Marks	100
Credits	01	Exam Hours	02

Pre-requisites: Basic Electronics and fundamentals of C programming.

List of Experiments

Part A: Basic Arduino Programming	
SN	**Experiments**
1	Getting Started with Arduino: Arduino platform, Prototyping environment
2	Arduino IDE: Arduino Development Environment, setting up the Arduino board with Electronic components and connections.
3	Arduino First Program: Creating sketches, using Libraries, using example codes, Debugging Using the Serial Monitor.
4	Arduino Interfaces- Different Sensors & Actuators
Part B: Basic Raspberry Pi Programming	
1	Getting Started with Raspberry Pi Basic functionality of the Raspberry Pi board and its Processor, setting and configuring the board
2	Introduction to Linux: Overview of Linux and its terminal Commands for operating Raspberry Pi
3	Programming the Raspberry Pi: Python-Introducing to Python programming language & Python Programming Environment
4	Exploring Electronics with the Raspberry Pi: Sensors & Actuator Interfacing
Part C: Open Ended Experiments / Mini-Project (Only for CIE, not for SEE)	
A Mini-project using Arduino / Raspberry Pi	

Course Outcomes:
At the end of the course the student will be able to:
1. Create sketches, libraries inside the Arduino Development Environment.
2. Wire Raspberry Pi and create a fully functional computer.
3. Use Python-based IDE, trace and debug Python code on Raspberry Pi.
4. Interface suitable sensors and actuators with Arduino / Raspberry Pi to measure and control physical world.
5. Implement the solution using arduino / raspberry pi for a given open ended problem.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author / s	Name of the Publisher	Edition and Year
Textbooks				
1	Arduino Cookbook	Michael Margolis,	O'Reilly Media	1st edition.
2	Raspberry Pi Cookbook for Python Programmers	Tim Cox	Packt Publishing Ltd.	2nd Revised edition, 2016
Reference Books				
1	Arduino for beginners : Essential Skills Every Maker Needs	John Baichtal	Pearson Education, Inc	1st edition, 2013
2	Raspberry Pi User Guide	Eben Ubton and Gareth Halfacree	John Wiley Publications	4th Edition. 2016

Semester: III
Course Name: DESIGN THINKING & INNOVATION

Course Code	21DTI39	CIE Marks	50
Teaching Hours / Week (L:T:P)	1:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	1	Exam Hours	02

Module-1

PROCESS OF DESIGN **Understanding Design thinking** Shared model in team-based design-Theory and practice in Design thinking-Explore presentation signers across globe-MVP or Prototyping **5 Hours**
Teaching-Learning Process:
1. Introduction about the design thinking: Chalk and Talk method 2. Theory and practice through presentation 3. MVP and Prototyping through live examples and videos

Module-2

Tools for Design Thinking Real-Time design interaction capture and analysis-Enabling efficient collaboration in digital space-Empathy for design-Collaboration in distributed Design **5 Hours**
Teaching-Learning Process:
1. Case studies on design thinking for real-time interaction and analysis 2. Simulation exercises for collaborated enabled design thinking 3. Live examples on the success of collaborated design thinking.

Module-3

Design Thinking in IT Design Thinking to Business Process modelling-Agile in Virtual collaboration environment-Scenario based Prototyping **5 Hours**
1. Case studies on design thinking and business acceptance of the design 2. Simulation on the role of virtual eco-system for collaborated prototyping 3. Chalk and Talk are used for Problem Solving.

Module-4

DT For strategic innovations Growth - Story telling representation - Strategic Foresight – Change - Sense Making - Maintenance Relevance - Value redefinition - Extreme Competition - experience Design – Standardization – Humanization - Creative Culture - Rapid prototyping, Strategy and Organization - Business Model **5 Hours**
Teaching-Learning Process:
1. Business model examples of successful designs. 2. Presentation by the students on the success of design. 3. Live project on design thinking in a group of 4 students.

Module-5

Design thinking workshop Design Thinking Workshop Empathize, Design, Ideate, Prototype and Test **5 Hours**
Teaching-Learning Process:
Design thinking workshop from the expect and then presentation by the students on the learning from the workshop

Course Outcomes:

At the end of the course the student will be able to,

C01: Identify the methods, processes, and tools of Design Thinking
C02: Apply the Design Thinking approach and model to real world situations
C03: Propose design ideas through different Technique
C04: Develop technical drawings for design ideas
C05: Execute innovation driven projects using design thinking principles

Suggested Learning Resources:

SN	Title of the Book	Name of the Author / s	Name of the Publisher	Edition and Year
Textbooks				
1	Engineering Design	John. R. Karsnitz, Stephen O'Brien and John P. Hutchinson	Cengage learning	2nd Edition, 2013
2	The Design of Business	Roger Martin	Harvard Business Press	2009
3	Design Thinking: Understand-Improve - Apply	Hasso Plattner, Christoph Meinel and Larry Leifer	Springer	2011
Reference Books				
1	Design Thinking for Strategic Innovation	Idris Mootee	John Wiley & Sons	2nd Edition, 2011
2	Engineering Design Process	Yousef Haik and Tamer M. Shahin	CengageLearning	1st edition, 2012

Semester: III
Course Name: ADDITIONAL MATHEMATICS-I

Course Code	21MATDIP31	CIE Marks	100
Teaching Hours / Week (L:T:P)	3:0:0	SEE Marks	-
Total Hours of Pedagogy	40	Total Marks	100
Credits	00	Exam Hours	-

Pre-requisites:
1. Algebraic formulae
2. Differentiation
3. Integration
4. Trigonometric formulae

Module – 1

Linear Algebra
Introduction-Rank of matrix by elementary row operations- Echelon form. Consistency of system of linear equations, Solution of linear equations-Gauss elimination method. Eigen values and Eigen vectors of a square matrix. Problems.
Self-Study: Gauss Jordon Method **8 Hours**

Module - 2

Differential Calculus:
Review of successive differentiation-Illustrative examples. Maclaurin's series expansions-Illustrative examples. Partial Differentiation: Euler's theorem-problems on first order derivatives only. Total derivatives-differentiation of composite functions. Jacobian of order two-problems.
Self-Study: Taylor's series expansion. **8 Hours**

Module – 3

Vector Differentiation:
Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and Vector point functions. Gradient, Divergence and Curl- Simple problems. Solenoidal and irrotational vector fields-Problems.
Self-Study: Angle between two surfaces **8 Hours**

Module – 4

Integral Calculus:
Review of elementary integral calculus. Reduction formulae for $Sin^n x, Cos^n x$(with proof) and $Sin^m x\ Cos^n x$ (without proof) and evaluation of these with standard limits- Examples. Double and triple integrals-Simple problems.
Self-Study: Change of Order of Integration. **8 Hours**

Module – 5

Ordinary Differential Equations:
Introduction-Solutions of first order and first degree differential equation: exact, Equation reducible to exact. Linear differential equations and Bernoulli's equation.
Self-Study: Homogeneous differential equations **8 Hours**

Course outcomes:
1. Upon Completion of this course, student will be able to,
2. Make use of matrix theory for solving system of linear equations and compute eigen values and Eigen vectors.
3. Learn the notion of partial differentiation to calculate the rate of change of multivariate functions and solve problems related to composite functions and Jacobians
4. Illustrate the applications of multivariate calculus to understand the solenoidal and irrotational vectors
5. Apply the concept of integration and variables to evaluate multiple integrals and their usage in computing the area and the volumes.
6. Solve first order linear differential equations analytically using standard methods.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author / s	Name of the Publisher	Edition and Year
Textbooks				
1	Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers	43rd Ed. 2015
2	Advanced Engineering Mathematics	E. Kreyszig	John Willy & Sons	10th Ed. (Reprint). 2016
3	Additional Mathematics-1	Dr. Pandurangappa	Sanguine Technical Publishers	4Th Ed. 2019.
Reference Books				
1	Higher Engineering Mathematics	B. V. Ramana	Tata McGraw-Hill	11th Edition. 2010

Teaching-Learning Process

The Course faculty and students are recommended to follow the appropriate strategies to facilitate teaching and learning process. The following are some of the suggested teaching-learning methods but not limited to:

- Black board presentation
- Power Point Presentation
- Demonstration through YouTube videos
- Demonstration through ICT Tools / Simulation tools / Virtual Labs
- Industrial Visits
- Self-Study, Case Study
- Flipped Class Room, Google Class Room

Assessment Details

The Assessment of Continuous Internal Examination / Evaluation (CIE) and Semester End Examination (SEE) for a course is planned based on the type** of course category.

Course Category	**BSC**	**Number of Credits**	**03**	**Semester**	**III**
Number of Courses	01				
List of Courses	**Course Code**	**Course Name**			
	21MEE31	Transform Calculus & Numerical Methods			

Assessment Details:

Continuous Internal Examination / Evaluation (CIE):

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B)

The Alternate Assessment Tools are Assignments, Quiz and Seminar

Semester End examination (SEE):

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

1. The question paper will have ten full questions carrying 20 marks each.
2. There will be two full questions (with a maximum of four sub questions) from each module.
3. The students will have to answer five full questions, selecting one full question from each module.

Course Category	IPCC	**Number of Credits**	04	**Semester**	III
Number of Courses	01				
List of Courses	**Course Code**	**Course Name**			
	21EC32	Basic Signal Processing			

Assessment Details:

Continuous Internal Examination / Evaluation (CIE):

CIE for the theory component of IPCC: 30 marks

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3	60%	18
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	12
	Total Marks for theory component (A+B)			**30**

The following are the Alternate Assessment Tools but not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

CIE for the LAB component of IPCC: 20 marks

	Components	**Weightage**	**Max. Marks**
(i)	Lab Work: Conduction of Experiments (A)	40%	08
(ii)	Lab Journal Writing & Submission (B)	10%	02
(iii)	Lab Test (C)	30%	06
(iv)	Open-Ended Experiments / Mini Lab Projects (D)	20%	04
	Total Marks (A+B+C+D)		**20**

Final CIE Marks = CIE for theory component + CIE for LAB component

Semester End examination (SEE):
SEE for IPCC Theory for **3 hours** duration

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. (Questions mentioned in the SEE paper shall include questions from the practical component)
- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04 / 05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Course Category	PCC-Theory	**Number of Credits**	03	**Semester**	III
Number of Courses	02				
List of Courses	**Course Code**	**Course Name**			
	21EC33	Digital Circuit Design using Verilog			
	21EC34	Analog Electronic Circuits			

Assessment Details:
Continuous Internal Examination / Evaluation (CIE):

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B)
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

Semester End Examination (SEE):
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

1. The question paper will have ten full questions carrying 20 marks each.
2. There will be two full questions (with a maximum of four sub questions) from each module.
3. The students will have to answer five full questions, selecting one full question from each module.

Course Category	PCC-Laboratory	**Number of Credits**	01	**Semester**	III
Number of Courses	02				
List of Courses	**Course Code**	**Course Name**			
	21ECL35	Digital Circuit Design Laboratory			
	21ECL36	Analog Electronic Circuits Laboratory			

Assessment Details:
Continuous Internal Examination / Evaluation (CIE):

	Components	**Weightage**	**Max. Marks**
(i)	Lab Work: Conduction of Experiments (A)	40%	20
(ii)	Lab Journal Writing & Submission (B)	10%	05
(iii)	Lab Test (C)	30%	15
(iv)	Open-Ended Experiments / Mini Lab Projects (D)	20%	10
	Total Marks (A+B+C+D)		**50**

Semester End Evaluation (SEE):

- SEE marks for the practical course is 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute.
- All laboratory experiments are to be included for practical examination.
- Based on the course requirement evaluation rubrics shall be decided jointly by examiners.

- Students can pick one question (experiment) from the questions lot prepared by the internal / external examiners jointly.
- Evaluation of test write-up / conduction procedure and result / viva will be conducted jointly by examiners.
- General rubrics suggested for SEE is mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks.
- SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.
- The duration of SEE is **03 hours**

Course Category	**HS**	**Number of Credits**	**01**	**Semester**	**III**
Number of Courses	02				
List of Courses	Course Code	Course Name			
	21CIP37	Constitution of India, professional Ethics and Cyber Law			
	21KSK37 / 21KBK37	Samskrutika Kannada / Balake Kannada			

Assessment Details:
For Constitution of India, professional Ethics and Cyber Law (21CIP37)

Continuous Internal Examination / Evaluation (CIE):

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B)
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

Semester End Examination (SEE):
- Theory SEE will be conducted with common question papers for the subject.
- The question paper will have 100 questions. Each question is set for 01 mark.
- SEE Pattern will be in MCQ Model (Multiple Choice Questions) for 100 marks which will be scaled down to 50 marks.
- Duration of the examination is 02 Hour.

For Samskrutika Kannada / Balake Kannada (21KSK37 / 21KBK37)

Continuous Internal Examination / Evaluation (CIE):

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3	60%	50
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	50
	Total Marks			**100**

Final CIE Marks = (A) + (B)
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, and Open Book etc.

Course Category	AEC-Theory	**Number of Credits**	01	**Semester**	III
Number of Courses	01				
List of Courses	Course Code	Course Name			
	21DTI39	Design Thinking and Innovation			

Assessment Details:
Continuous Internal Examination / Evaluation (CIE):

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

Semester End Examination (SEE):

- Theory SEE will be conducted with common question papers for subject.
- The question paper will have 100 questions. Each question is set for 01 mark.
- SEE Pattern will be in MCQ Model (Multiple Choice Questions) for 100 marks which will be scaled down to 50 marks.
- Duration of the examination is 02 Hour.

Course Category	AEC-Laboratory	**Number of Credits**	01	**Semester**	III
Number of Courses	01				
List of Courses	Course Code	Course Name			
	21AEC38	Programming with Hardware Controllers			

Assessment Details:

Continuous Internal Evaluation (CIE):

	Components	**Weightage**	**Max. Marks**
(i)	Lab Work: Conduction of Experiments (A)	40%	20
(ii)	Lab Journal Writing & Submission (B)	10%	05
(iii)	Lab Test (C)	30%	15
(iv)	Open-Ended Experiments / Mini Lab Projects (D)	20%	10
	Total Marks (A+B+C+D)		**50**

Semester End Evaluation (SEE):

- SEE marks for the practical course is 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute.
- All laboratory experiments are to be included for practical examination.
- Based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the internal / external examiners jointly.
- Evaluation of test write-up / conduction procedure and result / viva will be conducted jointly by examiners.
- General rubrics suggested for SEE is mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks.
- SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.
- The duration of SEE is 02 hours

Course Category	NCMC	**Number of Credits**	00	**Semester**	III
Number of Courses	01				
List of Courses	Course Code	Course Name			
	21MATDIP31	Additional Mathematics-I			

Assessment Details:
Continuous Internal Examination / Evaluation (CIE):

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3	60%	60
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	40
	Total Marks			**100**

Final CIE Marks = (A) + (B)
The Alternate Assessment Tools are Assignments, Quiz and Seminar
There is no SEE for Samskrutika Kannada / Balake Kannada (21KSK37 / 47 / 21KBK37 / 47) and Additional Mathematics-I (21MATDIP31), Additional Mathematics-II (21MATDIP41),

****IPCC:** Integrated Professional Core Course	**PCC:** Professional Core Course
AEC: Ability Enhancement Course	**BSC:** Basic Science Course
HS: Humanities and Sciences	**NCMC:** Non-Credit Mathematics Course
UHV: Universal Human Values	**INT:** Internship

Semester: IV

Course Name: LINEAR ALGEBRA, PROBABILITY AND STATISTICAL METHODS

Course Code	21MCE41	CIE Marks	50
Teaching Hours / Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	03

Pre-requisites:
1. Basic formulae of differentiation and Integration
2. Matrices and determinants
3. Statistics and probability

Module – 1

Vector Spaces and Linear Equations: Vector spaces and subspaces, Linear Independence, Basis and Dimension. The four fundamental Subspaces, Linear Transformation, Rank Nullity Theorem.
Orthogonality: Orthogonal vector, Projections, Least Square approximations, orthonormal bases and Gram-Schmitt Orthogonalization.
Self-Study: Gaussian Elimination. **8 Hours**

Module - 2

Determinants:
Eigen Values and Vectors: Introduction to Eigen values and vectors. Diagonalization of matrix, positive definite matrices (Tests for Positive definite matrices) Symmetric matrices (some important theorems) Singular Value decomposition (SVD)
Self-Study: transpose of a matrix **8 Hours**

Module – 3

Statistical Methods: Correlation and regression- Karl Pearson's coefficient of correlation and rank correlation, problems. Regression analysis, lines of regression, problems.

Curve Fitting: Curve fitting by the method of least squares, fitting the curves of the forms
$y = ax + b, y = ax^b \text{ and } y = ax^2 + bx + c$.
Self-Study: Angle between two regression lines, problems. **8 Hours**

Module – 4

Probability Distributions: Review of basic probability theory. Random Variable (discrete and continuous), probability mass and density functions. Mathematical expectation, mean and variance. Binomial, Poisson and normal distributions-problems (derivations for mean and standard deviation for Binomial and Poisson distributions only)-Illustrative examples.
Self-Study: Exponential distribution. **8 Hours**

Module – 5

Joint Probability Distribution: Joint Probability distribution for two discrete random variables, expectation, covariance and correlation.
Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, Student's t-distribution and Chi-square distribution as a test of goodness of fit.
Self-Study: Point estimation and interval estimation. **8 Hours**

Course Outcomes:

Upon completion of this course, student will be able to:
1. Understand the concept of Vector Spaces and its applications
2. Solve Differential equation and Discrete Dynamical system using the concept of Eigen value and Eigen Vector
3. Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
4. Applying discrete and continuous probability distributions in analysing the probability models arising in engineering field.
5. Construct joint probability distributions and demonstrate the validity of testing hypothesis.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author / s	Name of the Publisher	Edition and Year
Textbooks				
1	Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers	43rd Ed. 2015
2	Advanced Engineering Mathematics	E. Kreyszig	John Willy & Sons	10th Ed. (Reprint). 2016
3	Linear Algebra and its Applications	Gilbert Strang	Cengage Publishers	4th edition. 2014
4	Linear Algebra and Application	David C Lay	Pearson Education	6th edition
Reference Books				
1	Higher Engineering Mathematics	B. V. Ramana	Tata McGraw-Hill	11th Edition. 2010
2	Calculus	George. B. Thomas		
3	A Text book of Engineering Mathematics	N. P. Bali and Manish Goyal	Laxmi Publications	Latest edition
4	Linear Algebra	Kenneth Hoffmann, Ray Kunze	Prentice Hall India Learning Private Limited	2nd Edition 1978

Semester: IV
Course Name: Network Theory & Control Systems

Course Code	21EC42	CIE Marks	50
Teaching Hours / Week (L:T:P)	3:0:2	SEE Marks	50
Total Hours of Pedagogy	40+20	Total Marks	100
Credits	04	Exam Hours	03

Pre-requisites: Knowledge of complex numbers, Laplace transforms, differential equations, matrix algebra.

Module-1

Basic concepts and network theorems
Types of Sources, Loop analysis, Nodal analysis with independent DC and AC Excitations.
(Textbook 1: 2. 3, 4. 1, 4. 2, 4. 3, 4. 4, 10. 6)

Super position theorem, Thevenin's theorem, Norton's Theorem, Maximum Power transfer Theorem, Millimans Theorem, Reciprocity Theorem.
(Textbook 2: 9. 2, 9. 4, 9. 5, 9. 7) **8 Hours**

Self-study topics: KVL and KCL

Module-2

Two port networks: Short-circuit Admittance parameters, Open- circuit Impedance parameters, Transmission parameters, Hybrid parameters and inter-relation between the parameters.
(Textbook 3: 11. 1, 11. 2, 11. 3, 11. 4, 11. 5)

Laplace transform and its Applications: Step, Ramp, Impulse, Solution of networks using Laplace transform, Initial value and final value theorem
(Textbook 3: 7. 1, 7. 2, 7. 4, 7. 7, 8. 4) **8 Hours**

Self-study topics: Numerical problems on Laplace transforms

Module-3

Basic Concepts and representation of control systems :
Introduction to control systems, Types of control systems, effect of feedback systems, differential equation of physical systems (only electrical systems), Introduction to block diagrams, transfer functions, Signal Flow Graphs
(Textbook 4: Chapter 1. 1, 2. 2, 2. 4, 2. 5, 2. 6) **8 Hours**

Self-study topics: Numerical Problems on differential equations 1-D Kinematics

Module-4

Time Response analysis: Time response of first order systems. Time response of second order systems, time response specifications of second order systems (Textbook 4: Chapter 5. 3, 5. 4)
Stability Analysis: Concepts of stability necessary condition for stability, Routh stability criterion, relative stability Analysis (Textbook 4: Chapter 6. 1, 6. 2, 6. 4, 6. 5) **8 Hours**

Self-study topics: Time response of first order systems

Module-5

Root locus: Introduction the root locus concepts, construction of root loci (Textbook 4: 7. 1, 7. 2, 7. 3) Frequency Domain analysis and stability: Correlation between time and frequency response and Bode plots (Textbook 4: 8. 1, 8. 2, 8. 4)
State Variable Analysis: Introduction to state variable analysis: Concepts of state, state variable and state models. State model for Linear continuous -Time systems, solution of state equations.
(Textbook 4: 12. 2, 12. 3, 12. 6) **8 Hours**

Self-study topics: Stability analysis on second order systems (Practical Component)

PRACTICAL COMPONENT OF IPCC

SN	Experiments (For CIE only, not for SEE)
1	Verification of Superposition theorem
2	Verification of Thevenin's theorem
3	Speed torque characteristics of i)AC Servomotor ii) DC Servomotor
4	Determination of time response specification of a second order Under damped System, considering different damping factors.
5	Determination of frequency response of a second order System
6	Determination of frequency response of a lead lag compensator
7	Using Suitable simulation package study the speed control of DC motor using i) Armature control ii) Field control
8	Using suitable simulation package, draw Root locus & Bode plot for the given transfer function.

Demonstration Experiments

1	Using suitable simulation package, obtain the time response from state model of a system.
2	Implement a PID Controller and hence realize an Error Detector.
3	Demonstrate the effect of PI, PD and PID controller on the system response

Course Outcomes:

At the end of the course the student will be able to:

1. **Analyze** electrical circuits and two port networks by applying network concepts (loop analysis and network theorems)
2. **Deduce** transfer function of a given physical system, represented by differential equation, block diagram representation and SFG
3. **Analyze** the time response behavior for standard test input signals and construct the state model for the specified control system
4. **Perform** the stability of a system using numerical (Routh-Hurwitz criteria), graphical (root locus) approach and bode plot (frequency responses) approach.
5. **Demonstrate** the concept of electrical networks and control systems through simulation / emulation

Suggested Learning Resources:

SN	Title of the Book	Name of the Author / s	Name of the Publisher	Edition and Year
Textbooks				
1	Engineering circuit analysis	William H Hayt, Jr, Jack E Kemmerly, Steven M Durbin	Mc Graw Hill	8th Indian Edition (8e).
2	Networks and Systems	D Roy Choudhury	New age international Publishers	2nd edition
3	Network Analysis,	M E Van Valkenburg	Pearson	3rd edition.
4	Control Systems Engineering	J Nagrath, M. Gopal	New age international Publishers	5th edition

Semester: IV
Course Name: Digital Signal Processing

Course Code	21EC43	CIE Marks	50
Teaching Hours / Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Pre-requisites: Basics of Signal Processing and transformations (CFT, DTFT, ZT).

Module-1

Introduction Discrete Fourier Transforms (DFT): Frequency domain sampling and Reconstruction of Discrete Time Signals, The Discrete Fourier Transform, DFT as a linear transformation, Properties of the DFT: Periodicity, Linearity and Symmetry properties, Multiplication of two DFTs and Circular Convolution **[Text 1: Chapter 7: 7. 1, 7. 2]**	**8 Hours**
Self-Study Topics: Sampling theorem with conditions, Linear transformation	

Module-2

Linear filtering methods based on the DFT: Use of DFT in Linear Filtering, Filtering of Long Data Sequences (Overlap Save and Add). Fast-Fourier-Transform (FFT) algorithms: Efficient Computation of the DFT: Radix-2 FFT algorithms for the computation of DFT and IDFT decimation in- time, Chirp-z Transform, Goertzel Algorithm. **[Text 1:Chapter 7:7. 3, Chapter 8: 8. 1(8. 1. 1 to 8. 1. 3), 8. 3]**	**8 Hours**
Self-Study Topics: Difference between DFT and FFT. Application of Goertzel algorithm	

Module-3

Design of FIR Filters: Characteristics of practical frequency-selective filters, Symmetric and Anti- symmetric FIR filters, Design of Linear-phase FIR (low pass and High pass) filters using windows-Rectangular, Hamming, Hanning, Bartlett windows. Structure for FIR Systems: Direct form, Linear-phase form and Lattice structures. **[Text1:Ch10:10. 2(10. 2. 1, 10. 2. 2), Ch9:9. 2]**	**8 Hours**
Self-Study Topics: Types of windows and differences	

Module-4

IIR Filter Design: Infinite Impulse Response Filter Format, Bilinear Transformation Design Method, Analog Filters using Low pass prototype transformation, Normalized Butterworth and Chebyshev Functions, Bilinear Transformation and Frequency Warping, Bilinear Transformation Design Procedure, Digital Butterworth Filter Design using BLT. Realization of IIR Filters in Direct form I and II. **[Text 2:Ch 8:8. 1, 8. 2, 8. 3]**	**8 Hours**
Self-Study Topics: Difference between FIR and IIR	

Module-5

Digital Signal Processors: DSP Architecture, DSP Hardware Units, fixed point format, Floating point Format, IEEE Floating point formats, Fixed point digital signal processors. **[Text 2:Ch 9:9. 1 to 9. 4]**	**8 Hours**
Self-Study Topics: Different types of Architectures	

Course Outcomes:

At the end of the course the student will be able to:

1. **Analyze** the process of sampling and reconstruction of a given signal in frequency domain
2. **Compute** DFT of real and complex discrete time sequence using Linear Transformation Techniques.
3. **Analyze** the Fourier transform of discrete signal using FFT and linear filtering approaches.
4. **Design** digital IIR / FIR filters for a given specifications by choosing appropriate filtering techniques.
5. **Analyze** the DSP processor architecture and IEEE format representation of a given data sequence.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author / s	Name of the Publisher	Edition and Year
Textbooks				
1	Digital Signal Processing-Principles Algorithms & Applications	Proakis & Manolakis	Pearson education, New Delhi	4^{th} Edition & 2007
2	Digital Signal processing-Fundamentals and Applications	Li Tan, Jean Jiang	Academic Press	2^{nd} Edition 2013
Reference Books				
1	Digital Signal Processing, A Computer Based Approach	Sanjit K Mitra	McGraw Hill Education,	4^{th} edition, 2013
2	Discrete Time Signal Processing	Oppenheim & Schaffer	PHI	2003

Semester: IV
Course Name: Communication Systems- I

Course Code	21EC44	CIE Marks	50
Teaching Hours / Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Pre-requisites: Signals and Systems, Probability theory, Random Processes.

Module-1

Introduction to Communication System: Introduction, Elements of a Communication System, Need for Modulation, Electromagnetic Spectrum and Typical Applications, Terminologies in Communication Systems, Basics of Signal Representation and Analysis.
Amplitude Modulation (AM) Systems: Introduction, Time and Frequency domain representation, AM Generation-Switching Modulator, AM Detection- Envelop detector, significance of RC time constant in envelop detector, virtues, limitations, and modifications of amplitude modulation, Comparison of AM Modulation techniques- Standard AM, DSBSC, SSB and VSB, Frequency translation, Frequency division Multiplexing, Quadrature carrier Multiplexing.
(Text-1: 3. 1, 3. 2, 3. 4, 3. 7, 3. 8 & Text-2: 1. 1-1. 6) **8 Hours**

Self-study topics: Basic tools for Communication-Fourier Transforms, Trigonometric relations, Dirac Delta function.

Module-2

Angle Modulation: Basic Definitions- Description of phase modulation (PM) and Frequency modulation (FM), Properties of Angle modulated waves, Relationship between FM and PM.
Frequency Modulation (FM): Narrow band FM, Wideband FM, transmission bandwidth of FM signals using Carson's Rule.
Generation of FM Signals: Direct and Indirect method.
Demodulation of FM Signals: Balanced frequency discriminator and Phase locked loop.
FM stereo Multiplexing, Super heterodyne Receiver.
(Text-1: 4. 1-4. 6 &Text-2: Chapter 4) **8 Hours**

Self-study topics: EM Spectrum for FM Broadcasting system [Text-3], Survey on various FM stations around the state.

Module-3

Noise in Analog Modulation: Introduction, shot noise, thermal noise, white noise, Narrow band noise. Representation of noise in-terms of In phase and quadrature components, representation of noise in-terms of envelop and phase components.
Noise in AM Receivers: Signal to Noise Ratios, AM receiver Model, Noise in AM receivers, and Noise in DSBSC receivers.
Noise in FM Receivers: FM receiver Model, Noise in FM reception, FM threshold effect, pre-emphasis and de-emphasis in FM.
(Text-1: 5. 10, 6. 1-6. 6) **8 Hours**

Self-study topics: Gaussian Distribution, AWGN, Noise Figure, Power Spectral Density.

Module-4

Analog to Digital Transition: Introduction, Why Digitize Analog Sources? The Low pass Sampling Process, Practical aspects of sampling and signal recovery, Types of Sampling (Natural, Flat top / Sample and Hold, Impulse), Pulse Amplitude Modulation, Time Division Multiplexing, Pulse-Position Modulation, Theme Example- PPM in Impulse Radio.
(Text-1: 7. 1-7. 7) **8 Hours**

Self-study topics: Bandwidth requirements for TDM, T1 Carrier Systems- A Case Study (Text 3: 6. 3), Importance of Interleaving.

Module-5

Analog to Digital Transition (Cont. .): The Quantization Random Process, Quantization Noise, Types of Quantization, Pulse-Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing; Delta Modulation, Application examples- (a) Video + MPEG and (b) Vocoders.
Line Codes (RZ & NRZ): Unipolar, Polar, Bipolar, Manchester Coding / Signaling. Other baseband signaling- HDB3, BnZs
(Text-1: 7. 8-7. 11 & Text-3: 6. 8, 7. 1, 7. 2) **8 Hours**

Self-study topics: Digital Multiplexing.

Course Outcomes:
At the end of the course the student will be able to:
1. Apply mathematical tools / transformations to analyze the performance of amplitude modulation schemes (Standard AM, DSBSC, SSB & VSB).
2. Analyze FM modulated / demodulated signals from the learning resources and realize the design principles of FM in audio broadcasting.
3. Characterize the influence of channel noise on the modulated signals and analog receivers.
4. Relate the design principles of analog to digital transformations in context to digital signal processing / multimedia applications.
5. Design and Conduct experiment by way of simulation or emulation on analog communication subsystems targeting to specific radio applications.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author / s	Name of the Publisher	Edition and Year
Textbooks				
1	Communication Systems	Simon Haykins & M Moher	John Willey India Pvt. Ltd.	5th Edition & 2010
2	Electronic Communication Systems	George Kennedy, Bernard Davis & S R M Prasanna	McGraw Hill Education (India) Private Limited	5th Edition & 2015
3	Modern Digital and Analog Communication Systems	B P Lathi & Zhi Ding	Oxford University Press	4th Edition & 2010
Reference Books				
1	Principles of Communication Systems	H Taub & D L Schilling	TMH	3rd Edition & 2011
2	An Introduction to Analog and Digital Communication	Simon Haykins	John Willey India Pvt. Ltd.	2008

Semester: IV
Name of the Laboratory: Digital Signal Processing Laboratory

Course Code	21ECL45	CIE Marks	50
Teaching Hours / Week (L:T:P)	0:0:2	SEE Marks	50
Total Hours of Pedagogy	20	Total Marks	100
Credits	01	Exam Hours	03

Pre-requisites: Basics of Signal Processing and transformations (CFT, DTFT, ZT).

List of Experiments

Part A: List of Programs to be implemented & executed using MATLAB
1. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum. 2. Computation of circular convolution of two given sequences and verification of commutative, distributive and associative property of convolution. 3. Computation of linear convolution of two sequences using DFT and IDFT. 4. Computation of circular convolution of two given sequences using DFT and IDFT 5. Verification of Linearity property, circular time shift property & circular frequency shift property of DFT. 6. Verification of Parseval's theorem 7. Design and implementation of IIR (Butterworth) low pass filter to meet given specifications. 8. Design and implementation of IIR (Butterworth) high pass filter to meet given specifications. 9. Design and implementation of low pass FIR filter to meet given specifications. 10. Design and implementation of high pass FIR filter to meet given specifications.
Part B: List of Hardware Programs to be implemented & executed using CC Studio & TMS320C6713
1. To compute N- Point DFT of a given sequence using DSK 6713 simulator 2. To compute linear convolution of two given sequences using DSK 6713 simulator 3. To compute circular convolution of two given sequences using DSK 6713 simulator
Part C: Demo / Open Ended Experiments (Only for CIE, not for SEE)
1. Implementation of keypad using Goertzel Algorithm 2. Simulation based Face Recognition System 3. Any Open ended Experiments / Mini Lab Projects

Course outcomes:
1. **Determine** response of LTI systems using time domain and DFT techniques
2. **Compute** DFT of real and complex discrete time signals and its properties on MATLAB / DSP Processor.
3. **Compute** Linear and Circular Convolution and verify its properties.
4. **Design** FIR and IIR Digital Filters for a given specifications.
5. **Demonstrate** the solutions for the given open ended problem / Mini lab projects in the area of Digital signal Processing.

Suggested Learning Resources:
1. Lab Manual

Reference Books:

1. Digital Signal Processing: principles and Applications, Dimitris G. Manolakis. J. G. Proakis, Pearson 4th Ed.
2. Digital Signal processing, S. K. Mitra, Mc Graw Hill Education, 4th Ed.

Semester: IV
Name of the Laboratory: Communication Laboratory-I

Course Code	21ECL46	CIE Marks	50
Teaching Hours / Week (L:T:P)	0:0:2	SEE Marks	50
Total Hours of Pedagogy	20	Total Marks	100
Credits	01	Exam Hours	03

Pre-requisites: Signals and Systems, Analog and Digital circuit fundamentals, Probability theory and Random Processes.

List of Experiments

SN	Experiments
Part A:Design of Experiments using Discrete Components	
1	Design of active second order Butterworth Low pass and high pass filters
2	Amplitude Modulation and Demodulation of Standard AM
3	FM Signal generation (IC8038 / IC2206 can be used)
4	Pulse Amplitude Modulation and demodulation
5	Design and test BJT / FET Mixer
Part B: Design based / Simulation based Experiments using MATLAB / SCILAB / SIMULINK / LABVIEW etc.	
1	Illustration of (a) AM modulation and demodulation and display the signal and its spectrum. (b) DSB-SC modulation and demodulation and display the signal and its spectrum.
2	Illustration of FM modulation and demodulation and display the signal and its spectrum
3	Illustration of Pulse code modulation and demodulation
4	Illustration of Delta Modulation and the effects of step size selection in the design of DM encoder
5	Illustrate the process of sampling and reconstruction of low pass signals. Display the signals and its spectrums of both analog and sampled signals.
6	Simulate Line codes and Generate NRZ, RZ Unipolar and Polar signaling waveforms.
Part C: Demo / Kit based / Open Ended Experiments (Only for CIE, not for SEE)	
1	Demonstrate Time Division Multiplexing and De-multiplexing of two band limited signals.
2	Design of active Butterworth Band pass filter using Op-amp.
3	Pulse width Modulation
4	Phase Locked Loop Synthesis
5	Any Open ended Experiments / Mini Lab Projects

Course Outcomes:

At the end of the course the student will be able to:

1. Design and Validate 2^{nd} order active filters as per the given design Specifications (Cut-off frequency, Roll off factor, Gain, Bandwidth etc) and stability requirements.
2. Demonstrate the AM and FM modulation / Demodulation for a given specification through discrete circuit implementation and Measure its performance parameters (Modulation Index, Carrier frequency, Bandwidth etc).
3. Design and Test the Pulse Amplitude Modulation / demodulation using discrete circuits and Comment on sampling criteria / Conditions.
4. Test BJT / FET Mixer and realize the need of mixer and local oscillator in superheterodyne receivers.
5. Simulate / Emulate assorted communication system applications that involve signal transmission / recovery, modulation process, multiplexing, analog to digital signal transformations, line coding etc.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author / s	Name of the Publisher	Edition and Year
Textbooks				
1	Communication Systems	Simon Haykins & M Moher	John Willey India Pvt. Ltd.	5^{th} Edition & 2010
2	Modern Digital and Analog Communication Systems	B P Lathi & Zhi Ding	Oxford University Press	4^{th} Edition & 2010
3	Principles of Electronics Communication Systems	Louis E Frenzel	TMH	2016
Reference Books				
1	An Introduction to Analog and Digital Communication	Simon Haykins	John Willey India Pvt. Ltd.	2008
2	Principles of Communication Systems	H Taub & D L Schilling	TMH	2011

Semester: IV
Course Name: Soft Skills and Basic Aptitude

Course Code	21SSA480	CIE Marks	50
Teaching Hours / Week (L:T:P)	1:2:0	SEE Marks	50
Total Hours of Pedagogy	30	Total Marks	100
Credits	02	Exam Hours	02

Pre-requisites:
- Basic Conversational English
- Fundamentals of Mathematics
- Basic Knowledge of Reasoning

Module-1

Communication Skills
Basic Tools of Communication, Listening Skills, Body Language, Voice, Verbal Language, Conversations in Professional Setting **6 Hours**

Module-2

Presentation Skills
Zero Presentation, Individual Presentations, Feedback, Types of Introductions, Captivating the Audience, Interaction Methods, Signing off. **6 Hours**

Module-3

Verbal & Numerical Ability
Vocabulary is Fun, Root Words, Sentence Structures, Bouncing, Similar and Opposite Words, Common Errors, Number System, Factors and Multiples. **6 Hours**

Module-4

English Language
Phonetic and Non-phonetic Languages, sounds in English, IPA, Syllables, Word Stress, Stress patterns in Indian languages vs English, Pausing and Rhythm in English, Sentence Structures, Bouncing, Common Errors **6 Hours**

Module-5

Verbal Ability and Verbal Reasoning
Similar and Opposite words, Number and Alphabet Series, Human Relations, Direction Tests, Coding Decoding, Clocks and Calendars **6 Hours**

Course Outcomes:
At the end of the course the student will be able to:
1. Demonstrate communicative ability in a professional environment
2. Articulate one’s ideas and demonstrate them to an audience
3. Transform one’s English Vocabulary and Language Structure
4. Interpret international phonetic symbols, stress patterns, and enhance English speech
5. Identify patterns, determine the problem-solving process & validate solutions

Suggested Learning Resources:

SN	Title of the Book	Name of the Author / s	Name of the Publisher	Edition and Year
Textbooks				
1	Reasoning N’ Reasoning-Verbal & Non-verbal Reasoning	Dr. Ravi Chopra	Galgotia	1994
2	Magical Book on Quicker Math	M. Tyra	BSC	I Edition, 2018
3	Communicate With Confidence	Diana Booher	Mc-Graw-Hill	Nov 2011
Reference Books				
1	Cambridge Advanced Learner’s Dictionary	Cambridge University Press	CBS	IV Edition, 2013
2	A Modern Approach to Verbal and Non-verbal Reasoning	R S Agarwal	S Chand	II Edition, 2018
3	Word Power Made Easy	Norman Lewis	Goyal Publishers	IV Edition, 2014
4	Speak With Confidence	Diana Booher	Mc-Graw-Hill	I Edition, 2002

Semester: IV
Course Name: Digital System Design with FPGA

Course Code	21AEC482	CIE Marks	50
Teaching Hours / Week (L:T:P)	1:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	02

Pre-requisites: Familiarity with Digital logic and working knowledge of Verilog language

Module-1

Review of Logic Design Fundamentals & Verilog HDL: Combinational & Sequential Logic, Sequential Circuit Timing Diagram, Melay & Moore Sequential Circuit Design, Verilog HDL constructs & simple examples.

Textbook 1: Chapter 1 & Chapter 2 **3 Hours**

Module-2

Introduction to Programmable Logic Devices: Brief Overview of Programmable Logic Devices Simple Programmable Logic Devices (SPLDs), Complex Programmable Logic Devices (CPLDs), Field-Programmable Gate Arrays (FPGAs)

Textbook 1: 3. 1, 3. 2, 3. 3 and 3. 4 **4 Hours**

Module-3

FPGA Design and Verification Flow: Design Phase, Implementation Phase, Debug & Verification Phase, Static Timing analysis, Target to FPGA

Web link-1 **4 Hours**

Module-4

Designing with FPGAs: Implementing Functions in FPGAs, Implementing Functions Using Shannon's Decomposition, Carry Chains in FPGAs, Cascade Chains in FPGAs, Examples of Logic Blocks in Commercial FPGA, Dedicated Memory in FPGAs, Dedicated Multipliers in FPGAs, Cost of Programmability.

Textbook 1: 6. 1, 6. 2, 6. 3, 6. 4, 6. 5, 6. 6, 6. 7, 6. 8 **4 Hours**

Course Outcomes:

At the end of the course the student will be able to:

1. Explore different programmable logic devices and their use to design digital circuits.
2. Identify different phases in the FPGA Design and verification.
3. Employ Verilog language constructs to design a digital circuit and implement the solution on a FPGA board.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author / s	Name of the Publisher	Edition and Year
Textbooks				
1.	Digital System Design Using Verilog	Charles H Roth, Lizy Kurian John, Byeong Kil Lee	Cengage Learning	1st Edition, 2016
Web link:				
https://www.researchgate.net/figure/Design-flow-for-FPGA-based-systems_fig2_267478701				

Semester: IV
Course Name: Universal Human Values: Understanding Harmony and Ethical Human Conduct

Course Code	21UHV490	CIE Marks	50
Teaching Hours / Week (L:T:P)	1:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	02

Course Description:
This introductory course input is intended:

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

This course is intended to provide a much-needed orientational input in value education to the young enquiring minds.

Teaching-Learning Process (General Instructions)
These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.
1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. The course is in the form of 15 lectures (discussions)
3. It is free from any dogma or value prescriptions.
4. It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation-the whole existence is the lab and every activity is a source of reflection.
5. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous self- evolution.
6. This self-exploration also enables them to critically evaluate their pre-conditionings and present beliefs.

Module-1

Introduction to Value Education	**3 hours**
Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity-the Basic Human Aspirations, Happiness and Prosperity-Current Scenario, Method to Fulfil the Basic Human Aspirations	

Module-2

Harmony in the Human Being	**3 hours**
Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health	

Module-3

Harmony in the Family and Society	**3 hours**
Harmony in the Family-the Basic Unit of Human Interaction, 'Trust'-the Foundational Value in Relationship, 'Respect'-as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order	

Module-4

Harmony in the Nature / Existence	**3 hours**
Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence	

Module-5

Implications of the Holistic Understanding-a Look at Professional Ethics **3 hours**

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Course Outcomes:

At the end of the course the student will be able to:

1. Develop personality with responsibilities and self-respect.
2. Build real world skills like communication, lifelong-learning and problem-solving.
3. Create harmonious relationship among faculty and students.
4. Provide an organized philanthropic service to the society through activities.
5. Create awareness on health, yoga, human relationships, universal peace, environment, society and nation.

Suggested Learning Resources:

Text Book and Teachers Manual:

a. The Textbook
   A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN978-93-87034-47-1.

b. The Teacher's Manual
   Teacher's Manual for *A Foundation Course in Human Values and Professional Ethics*, R R Gaur, R Asthana.

Reference Books:

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A. N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth-by Mohandas Karamchand Gandhi
5. Small is Beautiful-E. F Schumacher.
6. Slow is Beautiful-Cecile Andrews
7. Economy of Permanence-J C Kumarappa
8. Bharat Mein Angreji Raj-Pandit Sunderlal
9. Rediscovering India-by Dharampal
10. Hind Swaraj or Indian Home Rule-by Mohandas K. Gandhi
11. India Wins Freedom-Maulana Abdul Kalam Azad
12. Vivekananda-Romain Rolland (English)
13. Gandhi-Romain Rolland (English)
14. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
15. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth-Club of Rome's report, Universe Books.
16. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
17. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
18. A N Tripathy, 2003, Human Values, New Age International Publishers.
19. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
20. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press
21. M Govindrajran, S Natrajan & V. S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
22. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
23. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co. Lucknow. Reprinted 2008.

Semester: IV
Course Name: Additional Mathematics-II

Course Code	21MATDIP41	CIE Marks	100
Teaching Hours / Week (L:T:P)	3:0:0	SEE Marks	--
Total Hours of Pedagogy	40	Total Marks	100
Credits	00	Exam Hours	00

Pre-requisites:

- Differentiation
- Integration
- Trigonometric formulae
- Differential equations

Module-1

Higher Order ODE's
Linear Differential equations of second and higher order equations with constant coefficients. Homogeneous / non-homogeneous equations. Inverse differential operators. [Particular integral restricted to $\phi(x) = e^{ax}, Sinax, Cosax$ for $f(D)y = \phi(x)$
Self-Study: Finding particular Integral for $\phi(x) = x^m$ **8 Hours**

Module-2

Partial Differential Equations (PDE's):
Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct by integration. Homogeneous PDE involving derivative with respect to one independent variable only.
Self-Study: Method of separation of variables **8 Hours**

Module-3

Laplace Transform:
Definition, Laplace transforms of elementary functions. Laplace transform of $e^{at}f(t), t^n f(t)$ (without proof). Laplace transform of Periodic functions (statement only) and Unit-step function- problems.

Inverse Laplace Transform: Definition, Inverse Laplace Transform of standard functions. Inverse transform by Partial fraction Method. Apply the concepts of Laplace Transforms to find the solution of linear differential equations.
Self-Study: Convolution Theorem **8 Hours**

Module-4

Numerical Methods:
Solution of algebraic and transcendental equations by Newton-Raphson method and Secant method.
Interpolation: Newton's Forward and Backward Interpolation formulae, Newton's divided difference formula, Lagrange's Interpolation formula-problems.
Numerical Integration: Simpson's 1 / 3rd and 3 / 8th rule (without proof)-problems.
Self-Study: Weddle's Rule **8 Hours**

Module-5

Probability:
Introduction, sample space and events. Axioms of probability. Addition & multiplication theorems. Conditional probability, Baye's theorem. Problems.
Self-Study: Applications Baye's theorm **8 Hours**

Course outcomes:
Upon completion of this course, student will be able to:
1. Demonstrate various physical models through higher order differential equations and solve such linear ordinary differential equations.
2. Construct a variety of partial differential equations and solution by various methods.
3. Use Laplace Transform and inverse Laplace Transform in solving differential / integral equation arising in network analysis, control systems and other fields of engineering
4. Apply the knowledge of numerical methods in the modeling of various physical and engineering phenomena.
5. Use the concepts of probability in different probability distribution.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author / s	Name of the Publisher	Edition and Year
Textbooks				
1	Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers	43rd Ed. 2015
2	Advanced Engineering Mathematics	E. Kreyszig	Jhon willy & Sons	10th Ed. (Reprint). 2016
3	Additional Mathematics-2	Dr. Pandurangappa	Sanguine Technical Publishers	4th Ed. 2019.
Reference Books				
1	Higher Engineering Mathematics	B. V. Ramana	Tata McGraw-Hill	11th Edition. 2010

Teaching-Learning Process

The Course faculty and students are recommended to follow the appropriate strategies to facilitate teaching and learning process. The following are some of the suggested teaching-learning methods but not limited to:

- Black board presentation
- Power Point Presentation
- Demonstration through YouTube videos
- Demonstration through ICT Tools / Simulation tools / Virtual Labs
- Industrial Visits
- Self-Study, Case Study
- Flipped Class Room, Google Class Room

Assessment Details

The Assessment of Continuous Internal Examination/Evaluation (CIE) and Semester End Examination (SEE) for a course is planned based on the type** of course category.

Course Category	BSC	**Number of Credits**	03	**Semester**	IV
Number of Courses	01				
List of Courses	**Course Code**	**Course Name**			
	21MCE41	Linear Algebra, Probability and Statistical Methods			

Assessment Details:

Continuous Internal Examination/ Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B)

The Alternate Assessment Tools are Assignments, Quiz and Seminar

Semester End examination (SEE):

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
The question paper will have ten full questions carrying 20 marks each.
There will be two full questions (with a maximum of four sub questions) from each module.
The students will have to answer five full questions, selecting one full question from each module.

Course Category	IPCC	**Number of Credits**	04	**Semester**	IV
Number of Courses	01				
List of Courses	**Course Code**	**Course Name**			
	21EC42	Network Theory & Control Systems			

Assessment Details:

Continuous Internal Examination/ Evaluation (CIE):

CIE for the theory component of IPCC: 30 marks

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	18
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	12
	Total Marks for theory component (A+B)			**30**

The following are the Alternate Assessment Tools but not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

CIE for the LAB component of IPCC: 20 marks

	Components	Weightage	Max. Marks
(i)	Lab Work: Conduction of Experiments (A)	40%	08
(ii)	Lab Journal Writing & Submission (B)	10%	02
(iii)	Lab Test (C)	30%	06
(iv)	Open-Ended Experiments / Mini Lab Projects (D)	20%	04
	Total Marks (A+B+C+D)		**20**

Final CIE Marks = CIE for theory component + CIE for LAB component

Semester End examination (SEE):
SEE for IPCC Theory for 3 hours duration

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. (Questions mentioned in the SEE paper shall include questions from the practical component)
- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Course Category	PCC-Theory	**Number of Credits**	03	**Semester**	IV
Number of Courses	02				
List of Courses	**Course Code**	**Course Name**			
	21EC43	Digital Signal Processing			
	21EC44	Communication Systems-I			

Assessment Details:
Continuous Internal Examination/ Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B)
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

Semester End examination (SEE):

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

Course Category	PCC-Laboratory	**Number of Credits**	01	**Semester**	IV
Number of Courses	02				
List of Courses	**Course Code**	**Course Name**			
	21ECL45	Digital Signal Processing Laboratory			
	21ECL46	Communication Laboratory-I			

Assessment Details:
Continuous Internal Examination/ Evaluation (CIE):

	Components	**Weightage**	**Max. Marks**
(i)	Lab Work: Conduction of Experiments (A)	40%	20
(ii)	Lab Journal Writing & Submission (B)	10%	05
(iii)	Lab Test (C)	30%	15
(iv)	Open-Ended Experiments / Mini Lab Projects (D)	20%	10
	Total Marks (A+B+C+D)		**50**

Semester End Evaluation (SEE):

- SEE marks for the practical course is 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute.
- All laboratory experiments are to be included for practical examination.
- Based on the course requirement evaluation rubrics shall be decided jointly by examiners.

- Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE is mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks.
- SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.
- The duration of SEE is 03 hours

Course Category	HS	**Number of Credits**	01	**Semester**	IV
Number of Courses	02				
List of Courses	**Course Code**	**Course Name**			
	21CIP47	Constitution of India, professional Ethics and Cyber Law			
	21KSK47/21KBK47	Samskrutika Kannada/Balake Kannada			

Assessment Details:
For Constitution of India, professional Ethics and Cyber Law (21CIP47)
Continuous Internal Examination/ Evaluation (CIE):

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B)
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

Semester End Examination (SEE):
- Theory SEE will be conducted with common question papers for the subject.
- The question paper will have 100 questions. Each question is set for 01 mark.
- SEE Pattern will be in MCQ Model (Multiple Choice Questions) for 100 marks which will be scaled down to 50 marks.
- Duration of the examination is 02 Hour.

For Samskrutika Kannada/Balake Kannada (21KSK47/21KBK47)
Continuous Internal Examination/ Evaluation (CIE):

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3*	60%	50
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	50
	Total Marks			**100**

Final CIE Marks = (A) + (B)
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Open Book etc.
Note: There is no SEE for the course Samskrutika Kannada/Balake Kannada (21KSK47/21KBK47)

Course Category	AEC-Theory	**Number of Credits**	02	**Semester**	IV
Number of Courses	01				
List of Courses	**Course Code**	**Course Name**			
	21SSA480	Soft skills and basic aptitude			

Assessment Details:
Continuous Internal Examination/ Evaluation (CIE):

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B)
Alternate Assessment Tool: 5-10 minute presentation (one on one – offline/online)

Semester End Examination (SEE):
The pattern of the question paper will be objective type (MCQ) for 100 marks and then reduced to 50 marks.
The time allotted for SEE is 02 hours

Course Category	AEC-Theory	**Number of Credits**	01	**Semester**	IV
Number of Courses	01				
List of Courses	**Course Code**	**Course Name**			
	21AEC482	Digital System Design with FPGA			

Assessment Details:

Continuous Internal Examination/ Evaluation (CIE):

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

Semester End Examination (SEE):

- The question paper will have 100 questions. Each question is set for 01 mark.
- SEE Pattern will be in MCQ Model (Multiple Choice Questions) for 100 marks which will be scaled down to 50 marks.
- Duration of the examination is 02

Course Category	UHV	**Number of Credits**	01	**Semester**	IV
Number of Courses	01				
List of Courses	**Course Code**	**Course Name**			
	21UHV490	Universal Human Values			

Assessment Details:
Continuous Internal Examination/ Evaluation (CIE):

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

Semester End Examination (SEE):

- Theory SEE will be conducted with common question papers for subject.
- The question paper will have 100 questions. Each question is set for 01 mark.
- SEE Pattern will be in MCQ Model (Multiple Choice Questions) for 100 marks which will be scaled down to 50 marks.
- Duration of the examination is 02

Course Category	NCMC	Number of Credits	00	Semester	IV
Number of Courses	01				
List of Courses	Course Code	Course Name			
	21MATDIP41	Additional Mathematics - II			

Assessment Details:

Continuous Internal Examination/ Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	60
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	40
	Total Marks			**100**

Final CIE Marks = (A) + (B)

Note: There is no SEE for the course Additional Mathematics - II

The Alternate Assessment Tools are Assignments, Quiz and Seminar

****IPCC:** Integrated Professional Core Course
PCC: Professional Core Course
AEC: Ability Enhancement Course
BSC: Basic Science Course
HS: Humanities and Sciences
NCMC: Non-Credit Mathematics Course
UHV: Universal Human Values
INT: Internship

V SEMESTER DETAILED SYLLABUS

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

MANAGEMENT AND ENTREPRENEURSHIP

Course Code	**18EE51**	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To introduce the field of management, task of the manager, importance of planning and types of planning, staff recruitment and selection process.
- To discuss the ways in which work is allocation, structure of organizations, modes of communication and importance of managerial control in business.
- To explain need of coordination between the manager and staff, the social responsibility of business and leadership.
- Toexplaintheroleandimportanceoftheentrepreneurineconomicdevelopmentandtheconceptsof entrepreneurship.
- To explain various types of entrepreneurs and their functions, the myths of entrepreneurship and the factors required for capacity building for entrepreneurs
- To discuss theimportanceofSmallScaleIndustriesandtherelatedtermsandproblemsinvolved.
- To discuss methods for generatingnewbusinessideasandbusinessopportunitiesinIndiaandtheimportance of business plan.
- To introduce the concepts of project management and discuss capitol building process.
- To explain project feasibility study and project appraisal anddiscuss project financing
- To discuss about different institutions at state and central levels supporting business enterprises. ■

Module-1

Management: Definition, Importance – Nature and Characteristics of Management, Management Functions, Roles of Manager, Levels of Management, Managerial Skills, Management & Administration, Management as a Science, Art &Profession.
Planning: Nature, Importance and Purpose Of Planning, Types of Plans, Steps in Planning, Limitations of Planning, Decision Making – Meaning, Types of Decisions- Steps in Decision Making. ■

Module-2

Organizing and Staffing: Meaning, Nature and Characteristics of Organization – Process of Organization, Principles of Organization, Departmentalization, Committees – meaning, Types of Committees, Centralization Versus Decentralization of Authority and Responsibility, Span of Control (Definition only), Nature and Importance of Staffing, Process of Selection and Recruitment.
Directing and Controlling: Meaning and Nature of Directing-Leadership Styles, Motivation Theories Communication – Meaning and Importance, Coordination- Meaning and Importance, Techniques of Coordination. Controlling – Meaning, Steps in Controlling. ■

Module-3

Social Responsibilities of Business: Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance. **Entrepreneurship**: Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Intrapreneur – An Emerging Class, Comparison between Entrepreneur and Intrapreneur, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for

Module-4

Modern Small Business Enterprises: Role of Small Scale Industries, Concepts and definitions of SSI Enterprises, Government policy and development of the Small Scale sector in India, Growth and Performance of Small Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries, Impact of Globalization on SSI, Impact of WTO/GATT on SSIs, Ancillary Industry and Tiny Industry (Definition only).
Institutional Support for Business Enterprises: Introduction, Policies & Schemes of Central–Level Institutions, State-Level Institutions.■

Module-5

Project Management: Meaning of Project, Project Objectives & Characteristics, Project Identification- Meaning & Importance; Project Life Cycle, Project Scheduling, Capital Budgeting, Generating an Investment Project Proposal, Project Report-Need and Significance of Report, Contents, Formulation, Project Analysis-Market, Technical, Financial, Economic, Ecological, Project Evaluation and Selection, Project Financing, Project Implementation Phase, Human & Administrative aspects of Project Management, Prerequisites for Successful Project Implementation.

New Control Techniques- PERT and CPM, Steps involved in developing the network, Uses and Limitations of PERT and CPM .■

Course Outcomes: At the end of the course the student will be able to:

- Explain the field of management, task of the manager, planning and steps in decision making.
- Discuss the structure of organization, importance of staffing, leadership styles, modes of communication, techniques of coordination and importance of managerial control in business.
- Explain the concepts of entrepreneurship and a businessman's social responsibilities towards different groups.
- Show an understanding of role of SSI's in the development of country and state/central level institutions/agencies supporting business enterprises.
- Discuss the concepts of project management, capital budgeting, project feasibility studies, need for project report and new control techniques.■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books

1	Principles of Management	P.C.Tripathi, P.N.Reddy	McGraw Hill,	6th Edition, 2017
2	Entrepreneurship Development And Small Business Enterprises	Poornima M.Charanthimath	Pearson	2nd Edition,2014

Reference Books

1	Dynamics of Entrepreneurial Development and Management	Vasant Desai	Himalaya Publishing House	2007
2	Essentials of Management: An International, Innovation and Leadership	Harold Koontz, Heinz Weihrich	McGraw Hill	10th Edition 2016

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

MICROCONTROLLER

Course Code	**18EE52**	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

- To explain the internal organization and working of Computers, microcontrollers and embedded processors.
- Compare and contrast the various members of the 8051 family.
- To explain the registers of the 8051 microcontroller, manipulation of data using registers and MOV instructions.
- To explain in detail the execution of 8051 Assembly language instructions and data types
- To explain loop, conditional and unconditional jump and call, handling and manipulation of I/O instructions.
- To explain different addressing modes of 8051, arithmetic, logic instructions, and programs.
- To explain develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic,

Module-1

8051 Microcontroller Basics: Inside the Computer, Microcontrollers and Embedded Processors, Block Diagram of 8051, PSW and Flag Bits, 8051 Register Banks and Stack, Internal Memory Organization of 8051, IO Port Usage in 8051, Types of Special Function Registers and their uses in 8051, Pins Of 8051. Memory Address Decoding, 8031/51 Interfacing With External ROM And RAM.8051 Addressing Modes. ■

Module-2

Assembly Programming and Instruction of 8051: Introduction to 8051 assembly programming, Assembling and running an 8051 program, Data types and Assembler directives, Arithmetic, logic instructions and programs, Jump, loop and call instructions, IO port programming. ■

Module-3

8051 Programming in C: Data types and time delay in 8051C, IO programming in 8051C, Logic operations in 8051 C, Data conversion program in 8051 C, Accessing code ROM space in 8051C, Data serialization using 8051C

8051 Timer Programming in Assembly and C: Programming 8051 timers, Counter programming, Programming timers 0 and 1 in 8051 C. ■

Module-4

8051 Serial Port Programming in Assembly and C: Basics of serial communication, 8051 connection to RS232, 8051 serial port programming in assembly, serial port programming in 8051 C.

8051 Interrupt Programming in Assembly and C: 8051 interrupts, Programming timer, external hardware, serial communication interrupt, Interrupt priority in 8051/52, Interrupt programming in C. ■

Module-5

Interfacing: LCD interfacing, Keyboard interfacing.
ADC, DAC and Sensor Interfacing: ADC 0808 interfacing to 8051, Serial ADC Max1112 ADC interfacing to 8051, DAC interfacing, Sensor interfacing and signal conditioning.
Motor Control: Relay, PWM, DC and Stepper Motor: Relays and opt isolators, stepper motor interfacing, DC motor interfacing and PWM.
8051 Interfacing with 8255: Programming the 8255, 8255 interfacing, C programming for 8255. ■

Course Outcomes: At the end of the course the student will be able to:

- Outline the 8051 architecture, registers, internal memory organization, addressing modes.
- Discuss 8051 addressing modes, instruction set of 8051, accessing data and I/O port programming.
- Develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic and arithmetic operations, data conversion and timer/counter programming.
- Summarize the basics of serial communication and interrupts, also develop 8051 programs for serial data communication and interrupt programming.
- Program 8051 to work with external devices for ADC, DAC, Stepper motor control, DC motor control, Elevator control. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Book

1	The 8051 Microcontroller and Embedded Systems Using Assembly and C	Muhammad Ali Mazadi	Pearson	2nd Edition, 2008.

Reference Books

1	The 8051 Microcontroller	Kenneth Ayala	Cengage Learning	3rd Edition, 2005
2	The 8051 Microcontroller and Embedded Systems	Manish K Patel	McGraw Hill	2014
3	Microcontrollers: Architecture, Programming, Interfacing and System Design	Raj Kamal	Pearson	1st Edition, 2012

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - V			
POWER ELECTRONICS			
Course Code	**18EE53**	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

- To give an overview of applications power electronics, different types of power semiconductor devices, their switching characteristics.
- To explain power diode characteristics, types, their operation and the effects of power diodes on RL circuits.
- To explain the techniques for design and analysis of single phase diode rectifier circuits.
- To explain different power transistors, their steady state and switching characteristics andimitations.
- To explain different types of Thyristors, their gate characteristics and gate control requirements.
- To explain the design, analysis techniques, performance parameters and characteristics of controlled rectifiers, DC- DC, DC -AC converters and Voltage controllers.

Module-1

Introduction: Applications of Power Electronics, Types of Power Electronic Circuits, Peripheral Effects, Characteristics and Specifications of Switches.

Power Diodes: Introduction, Diode Characteristics, Reverse Recovery Characteristics, Power Diode Types, Silicon Carbide Diodes, Silicon Carbide Schottky Diodes, Freewheeling diodes ,Freewheeling diodes with RL load.

Diode Rectifiers: Introduction, Diode Circuits with DC Source connected to R and RL load, Single-Phase Full-Wave Rectifiers with R load , Single-Phase Full-Wave Rectifier with RL Load . ■ **T1 & R1**

Module-2

Power Transistors: Introduction, Power MOSFETs – Steady State Characteristics, Switching Characteristics Bipolar Junction Transistors – Steady State Characteristics, Switching Characteristics, Switching Limits, IGBTs, MOSFET Gate Drive, BJT Base Drive, Isolation of Gate and Base Drives, Pulse transformers and Opto-couplers.■ **T1**

Module-3

Thyristors: Introduction, Thyristor Characteristics, Two-Transistor Model of Thyristor, Thyristor Turn-On, Thyristor Turn-Off, A brief study on Thyristor Types, Series Operation of Thyristors, Parallel Operation of Thyristors, *di/dt*Protection, *dv/dt*Protection, DIACs, Thyristor Firing Circuits, Unijunction Transistor.■ **T1**

Module-4

Controlled Rectifiers: Introduction, Single phase half wave circuit with RL Load, Single phase half wave circuit with RL Load and Freewheeling Diode, Single phase half wave circuit with RLE Load, Single-Phase Full Converters with RLE Load, Single-Phase Dual Converters, Principle of operation of Three- Phase duel Converters.

AC Voltage Controllers: Introduction, Principle of phase control & Integral cycle control, Single-Phase Full-Wave Controllers with Resistive Loads, Single- Phase Full-Wave Controllers with Inductive Loads, Three-Phase Full-Wave Controllers. ■ **T1 & R1**

Module-5

DC-DC Converters: Introduction, principle of step down and step up chopper with RL load, performance parameters, DC-DC converter classification**.**

DC-AC Converters: Introduction, principle of operation single phase bridge inverters, three phase bridge inverters, voltage control of single phase inverters, Harmonic reductions, Current source inverters.■ **T1**

Course Outcomes: At the end of the course the student will be able to:

- To give an overview of applications power electronics, different types of power semiconductor devices, their switching characteristics, power diode characteristics, types, their operation and the effects of power diodes on RL circuits.
- To explain the techniques for design and analysis of single phase diode rectifier circuits.
- To explain different power transistors, their steady state and switching characteristics and limitations.
- To explain different types of Thyristors, their gate characteristics and gate control requirements.
- To explain the design, analysis techniques, performance parameters and characteristics of controlled rectifiers, DC- DC, DC -AC converters and Voltage controllers. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Book

1	Power Electronics: Circuits Devices and Applications	Mohammad H Rashid,	Pearson	4th Edition, 2014

Reference Books

1	Power Electronics	P.S. Bimbhra	Khanna Publishers	5th Edition, 2012
2	Power Electronics: Converters, Applications and Design	Ned Mohan et al	Wiley	3rd Edition, 2014
3	Power Electronics	Daniel W Hart	McGraw Hill	1st Edition, 2011
4	Elements of Power Electronics	Philip T Krein	Oxford	Indian Edition, 2008

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

SIGNALS AND SYSTEMS

Course Code	**18EE54**	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To discuss arising of signals in different systems.
- To classify the signals and define certain elementary signals.
- To explain basic operations on signals and properties of systems.
- To explain the use of convolution integral and convolution summation in analyzing the response of linear time invariant systems in continuous and discrete time domains.
- To explain the properties of linear time invariant systems in terms of impulse response description.
- To explain determination of response of a given linear time invariant system and to provide a block diagram representation to it.
- To explain Fourier transform representation of continuous time and discrete time non –periodic signals and the properties of Fourier Transforms.
- To explain the applications of Fourier transform representation to study signals and linear time invariant systems. To explain the use of Z-transform in the complex exponential representation of discrete time signals and the analysis of systems. ■

Module-1

Introduction: Definitions of signals and a system, classification of signals, basic operations on signals. Elementary signals viewed as interconnections of operations, properties of systems**.** ■

Module-2

Time – Domain Representations for LTI Systems: Convolution, impulse response, properties, solution of differential and difference equations, block diagram representation. ■

Module-3

The Continuous-Time Fourier Transform: Representation of a non -periodic signals: continuous-time Fourier transform (FT), Properties of continuous-time Fourier transform, Applications. Frequency response of LTI systems, Solutions of differential equations. ■

Module-4

The Discrete-Time Fourier Transform: Representations of non-periodic signals: The discrete-time Fourier transform (DTFT), Properties of DTFT and applications. Frequency response of LTI system, Solutions of difference equations. ■

Module-5

Z- Transforms: Introduction, Z-transform, properties of ROC, properties of Z-transforms, inversion of Z-transform methods - power series and partial expansion, Transforms analysis of LTI systems, transfer function, stability and causality, unilateral Z-transform and its application to solve difference equations. ■

Course Outcomes: At the end of the course the student will be able to:

- Explain the generation of signals, behavior of system and the basic operations that can be performed on signals and properties of systems.
- Apply convolution in both continuous and discrete domain for the analysis of systems given impulse response of a system.
- Solve the continuous time and discrete time systems by various methods and their representation by block diagram.
- Perform Fourier analysis for continuous and discrete time, linear time invariant systems.
- Apply Z-transform and properties of Z transform for the analysis of discrete time systems. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.

Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	Signals and Systems	Simon Haykin, Berry Van Veen	Wiley	2nd Edition,2002
Reference Books				
1	Fundamentals of Signals and Systems	Michael J. Roberts, Govind K Sharma	McGraw Hill	2nd Edition 2010
2	Signals and Systems	NagoorKani	McGraw Hill	1st Edition 2010
3	Signals and Systems A Primer with MATLAB	Matthew N.O. Sadiku Warsame H. Ali	CRC Press	1st Edition, 2016
4	Signals and Systems	Anand Kumar	PHI	3rd Edition, 2015

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

ELECTRICAL MACHINE DESIGN (Core Course)

Course Code	**18EE55**	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To discuss design factors, limitations in design and modern trends in design and manufacturing of electrical machines.
- To discuss the properties of electrical, magnetic and insulating materials used in the design of electrical machines.
- To derive the output equation of DC machine, single phase, three phase transformers, induction motor and synchronous machines.
- To discuss the selection of specific loadings, for various machines.
- To discuss separation of main dimensions for different electrical machines
- To discuss design of field windings for DC machines and synchronous machines. To evaluate the performance parameters of transformer, induction motor.
- To design of cooling tubes for the transformer for a given temperature rise.
- To explain design of rotor of squirrel cage rotor and slip ring rotor.
- To define short circuit ratio and discuss its effect on machine performance. ∎

Module-1

Fundamental Aspects of Electrical Machine Design: Design of Machines, Design Factors, Limitations in design, Modern Trends in design, manufacturing Techniques.

Electrical Engineering Materials: Desirabilities of Conducting Materials, Comparison of Aluminium and Copper wires. Ferromagnetic Materials: Soft Magnetic materials – Solid Core Materials, Electrical Sheet and Strip, Cold Rolled Grain Oriented Steel. Insulating Materials: Desirable Properties, Temperature Rise and Insulating Materials, Classification of Insulating materials based on Thermal Consideration. ∎

Module-2

Design of DC Machines: Output Equation, Choice of Specific Loadings and Choice of Number of Poles, Main Dimensions of armature, Design of Armature Slot Dimensions, Commutator and Brushes. Estimation of Ampere Turns for the Magnetic Circuit. Dimensions of Yoke, Main Pole and Air Gap. Design of Shunt and Series Field Windings. ∎

Module-3

Design of Transformers: Output Equations of Single Phase and Three Phase Transformers, Choice of Specific Loadings, Expression for Volts/Turn, Determination of Main Dimensions of the Core, Estimation of Number of Turns and Conductor Cross Sectional area of Primary and Secondary Windings, No Load Current. Expression for the Leakage Reactance of core type transformer with concentric coils, and calculation of Voltage Regulation. Design of Tank and Cooling (Round and Rectangular) Tubes. ∎

Module-4

Design of Three Phase Induction Motors: Output Equation, Choice of Specific Loadings, Main Dimensions of Stator. Design of stator slots and Winding, Choice of Length Air Gap, Estimation of Number of Slots for Squirrel Cage Rotor. Design of Rotor Bars and End Ring. Design of Slip Ring rotor. Estimation of No Load Current and Leakage Reactance. ∎

Module-5

Design of Three Phase Synchronous Machines: Output Equation, Choice of Specific Loadings, Short Circuit Ratio, Main Dimensions of Stator. Design of stator slots and Winding. Design of Salient and non- salient Pole Rotors. Magnetic Circuit and Field Winding. ∎

Course Outcomes: At the end of the course the student will be able to:

- Identify and list, limitations, modern trends in design, manufacturing of electrical machines and properties of materials used in the electrical machines.
- Derive the output equation of DC machine, discuss selection of specific loadings and magnetic circuits of DC machines, design the field windings of DC machine, and design stator and rotor circuits of a DC machine.
- Derive the output equations of transformer, discuss selection of specific loadings, estimate the number of cooling tubes, no load current and leakage reactance of core type transformer.
- Develop the output equation of induction motor, discuss selection of specific loadings and magnetic circuits of induction motor, design stator and rotor circuits of a induction motor.
- Formulate the output equation of alternator, design the field windings of Synchronous machine, discuss short circuit ratio and its effects on performance of synchronous machines, design salient pole and non-salient pole alternators for given specifications.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Book

1	A course in Electrical Machine design	A.K.Sawhney	DhanpatRai	6th Edition, 2013

Reference Books

1	Performance and Design of Alternating Current Machines	M.G. Say	CBS Publisher	3rd Edition, 2002
2	Design Data Handbook	A. Sanmugasundaram Et al	New Age International	1st Edition, 2011

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

HIGH VOLTAGE ENGINEERING

Course Code	**18EE56**	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Credits - 03

Course Learning Objectives:

- To discuss conduction and breakdown in gases, liquid dielectrics.
- To discuss breakdown in solid dielectrics.
- To discuss generation of high voltages and currents and their measurement.
- To discuss overvoltage phenomenon and insulation coordination in electric power systems.

Module-1

Conduction and Breakdown in Gases: Gases as Insulating Media, Collision Process, Ionization Processes, Townsend's Current Growth Equation, Current Growth in the Presence of Secondary Processes, Townsend's Criterion for Breakdown, Experimental Determination of Coefficients α and γ, Breakdown in Electronegative Gases, Time Lags for Breakdown, Streamer Theory of Breakdown in Gases, Paschen's Law, Breakdown in Non-Uniform Fields and Corona Discharges. **Conduction and Breakdown in Liquid Dielectrics:** Liquids as Insulators, Pure Liquids and Commercial Liquids, Conduction and Breakdown in Pure Liquids, Conduction and Breakdown in Commercial Liquids.

Breakdown in Solid Dielectrics: Introduction, Intrinsic Breakdown, Electromechanical Breakdown, Thermal Breakdown.

Module-2

Generation of High Voltages and Currents: Generation of High Direct Current Voltages, Generation of High Alternating Voltages, Generation of Impulse Voltages, Generation of Impulse Currents, Tripping and Control of Impulse Generators.

Module-3

Measurement of High Voltages and Currents: Measurement of High Direct Current Voltages, Measurement of High AC and Impulse Voltages, Measurement of High Currents – Direct, Alternating and Impulse, Cathode Ray Oscillographs for Impulse Voltage and Current Measurements.

Module-4

Overvoltage Phenomenon and Insulation Coordination in Electric Power Systems: National Causes for Overvoltages - Lightning Phenomenon, Overvoltage due to Switching Surges, System Faults and Other Abnormal, Principles of Insulation Coordination on High Voltage and Extra High Voltage Power Systems.

Module-5

Non-Destructive Testing of Materials and Electrical Apparatus: Introduction, Measurement of Dielectric Constant and Loss Factor, Partial Discharge Measurements.

High Voltage Testing of Electrical Apparatus: Testing of Insulators and Bushings, Testing of Isolators and Circuit Breakers, Testing of Cables, Testing of Transformers, Testing of Surge Arrestors, Radio Interference Measurements, Testing of HVDC Valves and Equipment.

Course Outcomes: At the end of the course the student will be able to:

- Explain conduction and breakdown phenomenon in gases, liquid dielectrics and breakdown phenomenon in solid dielectrics.
- Summarize generation of high voltages and currents
- Outline measurement techniques for high voltages and currents.
- Summarize overvoltage phenomenon and insulation coordination in electric power systems.
- Explain non-destructive testing of materials and electric apparatus, high-voltage testing of electric apparatus

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Book

1	High Voltage Engineering	M.S. Naidu, V.Kamaraju	McGraw Hill	5^{th} Edition, 2013.

Reference Books

1	High Voltage Engineering Fundamentals	E. Kuffel, W.S. Zaengl, J. Kuffel	Newnes	2^{nd} Edition, 2000
2	High Voltage Engineering	Wadhwa C.L.	New Age International	3^{rd} Edition, 2012
3	High-Voltage Test and Measuring Techniques	Wolfgang Hauschild Eberhard Lemke	Springer	1^{st} Edition2014
4	High Voltage Engineering	Farouk A.M. Rizk	CRC Press	1^{st} Edition2014
5	Fundamental of High Voltage Engineering	Ravindra Arora, Bharat Singh Rajpurohit	Wiley	2019

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

MICROCONTROLLER LABORATORY

Course Code	**18EEL57**	CIE Marks	40
Number of Practical Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	3

Course Learning Objectives:

- To explain writing assembly language programs for data transfer, arithmetic, Boolean and logical instructions.
- To explain writing assembly language programs for code conversions.
- To explain writing assembly language programs using subroutines for generation of delays, counters, configuration of SFRs for serial communication and timers.
- To perform interfacing of stepper motor and DC motor for controlling the speed.
- To explain generation of different waveforms using DAC interface. ■

Sl. No.	Experiments
Note: For the experiments 1 to 6, 8051 assembly programming is to be used.	
1	Data transfer – Program for block data movement, sorting, exchanging, finding largest element in an array.
2	Arithmetic instructions: Addition, subtraction, multiplication and division. Square and cube operations for
3	Counters
4	Boolean and logical instructions (bit manipulation).
5	Conditional call and return instructions.
6	Code conversion programs – BCD to ASCII, ASCII to BCD, ASCII to decimal, Decimal to ASCII, Hexa
7	Programs to generate delay, Programs using serial port and on-chip timer/counters.
Note: Single chip solution for interfacing 8051 is to be with C Programs for the following experiments.	
8	Stepper motor interface.
9	DC motor interface for direction and speed control using PWM.
10	Alphanumerical LCD panel interface.
11	Generate different waveforms: Sine, Square, Triangular, Ramp using DAC interface.
12	External ADC and Temperature control interface.
13	Elevator interface.

Course Outcomes: At the end of the course the student will be able to:

- Write assembly language programs for data transfer, arithmetic, Boolean and logical instructions and code conversions.
- Write ALP using subroutines for generation of delays, counters, configuration of SFRs for serial communication and timers.
- Perform interfacing of stepper motor and dc motor for controlling the speed, elevator, LCD, external ADC and temperature control.
- Generate different waveforms using DAC interface.
- Work with a small team to carryout experiments using microcontroller concepts and prepare reports that present lab work.■

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

POWER ELECTRONICS LABORATORY

Course Code	**18EEL5**	CIE Marks	40
Number of Practical Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To conduct experiments on semiconductor devices to obtain their static characteristics.
- To study different methods of triggering the SCR
- To study the performance of single phase controlled full wave rectifier and AC voltage controller with R and RL loads.
- To control the speed of a DC motor, universal motor and stepper motors.
- To study single phase full bridge inverter connected to resistive load. ■

Sl. No	Experiments
1	Static Characteristics of SCR.
2	Static Characteristics of MOSFET and IGBT.
3	Characteristic of TRIAC.
4	SCR turn on circuit using synchronized UJT relaxation oscillator.
5	SCR digital triggering circuit for a single phase controlled rectifier and ac voltage regulator.
6	Single phase controlled full wave rectifier with R load, R –L load, R-L-E load with and without free wheeling diode
7	AC voltage controller using TRIAC and DIAC combination connected to R and RL loads.
8	Speed control of DC motor using single semi converter.
9	Speed control of stepper motor.
10	Speed control of universal motor using ac voltage regulator.
11	Speed control of a separately excited D.C. Motor using an IGBT or MOSFET chopper.
12	Single phase MOSFET/IGBT based PWM inverter.

Course Outcomes: At the end of the course the student will be able to:

- Obtain static characteristics of semiconductor devices to discuss their performance.
- Trigger the SCR by different methods
- Verify the performance of single phase controlled full wave rectifier and AC voltage controller with R and RL loads.
- Control the speed of a DC motor, universal motor and stepper motors.
- Verify the performance of single phase full bridge inverter connected to resistive load. ■

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – V

ENVIRONMENTAL STUDIES

Course Code	**18CIV59**	CIE Marks	40
Teaching Hours / Week (L:T:P)	(1:0:0)	SEE Marks	60
Credits	01	Exam Hours	02

Module - 1

Ecosystems (Structure and Function): Forest, Desert, Wetlands, Riverine, Oceanic and Lake.
Biodiversity: Types, Value; Hot-spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.

Module - 2

Advances in Energy Systems (Merits, Demerits, Global Status and Applications)**:** Hydrogen, Solar, OTEC, Tidal and Wind.
Natural Resource Management (Concept and case-studies): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading.

Module - 3

Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies)**:** Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution.
Waste Management & Public Health Aspects: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.

Module - 4

Global Environmental Concerns (Concept, policies and case-studies):Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.

Module - 5

Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications): G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship- NGOs.
Field work: Visit to an Environmental Engineering Laboratory or Green Building or Water Treatment Plant or Waste water treatment Plant; ought to be Followed by understanding of process and its brief documentation.

Course Outcomes: At the end of the course, students will be able to:
- CO1: Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale,
- CO2: Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
- CO3: Demonstrate ecology knowledge of a complex relationship between biotic and abiotic components.
- CO4: Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.

Question paper pattern:
- The Question paper will have 100 objective questions.
- Each question will be for 01 marks
- Student will have to answer all the questions in an OMR Sheet.
- The Duration of Exam will be 2 hours.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbook/s				
1	Environmental Studies	Benny Joseph	Tata Mc Graw – Hill.	2nd Edition, 2012
2.	Environmental Studies	S M Prakash	Pristine Publishing House, Mangalore	3rd Edition, 2018
3	Environmental Studies – From Crisis to Cure	R Rajagopalan	Oxford Publisher	2005
Reference Books				
1	Principals of Environmental	Raman Sivakumar	Cengage learning,	2nd Edition, 2005

	Science and Engineering		Singapur.	
2	Environmental Science – working with the Earth	G.Tyler Miller Jr.	Thomson Brooks /Cole,	11thEdition, 2006
3	Text Book of Environmental and Ecology	Pratiba Sing, Anoop Singh& Piyush Malaviya	Acme Learning Pvt. Ltd. New Delhi.	1stEdition

VI SEMESTER DETAILED SYLLABUS

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

CONTROL SYSTEMS (Core Subject)

Course Code	**18EE61**	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

- To define a control system
- To explain the necessity of feedback and types of feedback control systems.
- To introduce the concept of transfer function and its application the modeling of linear systems.
- To demonstrate mathematical modeling of control systems.
- To obtain transfer function of systems through block diagram manipulation and reduction
- To use Mason's gain formula for finding transfer function of a system
- To discuss transient and steady state time response of a simple control system.
- To discuss the stability of linear time invariant systems and Routh-Hurwitz criterion
- To investigate the trajectories of the roots of the characteristic equation when a system parameter is varied.
- To conduct the control system analysis in the frequency domain.
- To discuss stability analysis using Bode plots.
- To determine the controller or compensator configuration and parameter values relative to how it is

Module-1

Introduction to Control Systems: Introduction, classification of control systems.

Mathematical models of physical systems: Modelling of mechanical system elements, electrical systems, Analogous systems, Transfer function, Single input single output systems, Procedure for deriving transfer functions, servomotors, synchros, gear trains. ■

Module-2

Block Diagram: Block diagram of a closed loop system, procedure for drawing block diagram and block diagram reduction to find transfer function.

Signal Flow Graphs: Construction of signal flow graphs, basic properties of signal flow graph, signal flow graph algebra, construction of signal flow graph for control systems. ■

Module-3

Time Domain Analysis: Standard test signals, time response of first order systems, time response of second order systems, steady state errors and error constants, types of control systems.

Routh Stability Criterion: BIBO stability, Necessary conditions for stability, Routh stability criterion, difficulties in formulation of Routh table, application of Routh stability criterion to linear feedback systems, relative stability analysis. ■

Module-4

Root locus Technique: Introduction, root locus concepts, construction of root loci, rules for the construction of root locus.

Frequency Response Analysis: Co-relation between time and frequency response – 2nd order systems only.

Bode Plots: Basic factors G(iw)/H(jw), General procedure for constructing bode plots, computation of gain margin and phase margin. ■

Module-5

Nyquist plot: Principle of argument, Nyquist stability criterion, assessment of relative stability using Nyquist criterion.

Design of Control Systems: Introduction, Design with the PD Controller, Design with the PI Controller, Design with the PID Controller, Design with Phase-Lead Controller, Design with Phase - Lag Controller, Design with Lead-Lag Controller. ■

Course Outcomes: At the end of the course the student will be able to:

- Analyze and model electrical and mechanical system using analogous.
- Formulate transfer functions using block diagram and signal flow graphs.
- Analyze the stability of control system, ability to determine transient and steady state time response.
- Illustrate the performance of a given system in time and frequency domains, stability analysis using Root locus and Bode plots.
- Discuss stability analysis using Nyquist plots, Design controller and compensator for a given specification.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Book

1	Control Systems	Anand Kumar	PHI	2nd Edition,2014

Reference Books

1	Automatic Control Systems	Farid Golnaraghi, BenjaminC. Kuo	Wiley	9 Edition,2010
2	Control System Engineering	NormanS. Nise	Wiley	4 Edition,2004
3	Modern Control Systems	Richard C Dorfetal	Pearson	11 Edition,2008
4	Control Systems, Principles and	M. Gopal	McGawHill	4 Edition,2012
5	Control Systems Engineering	S. Salivahananet al	Pearson	1 Edition,2015

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VI			
POWER SYSTEM ANALYSIS – 1 (Core Subject)			
Course Code	18EE62	CIE Marks	4
Number of Lecture Hours/Week (L:T:P)	3:2:0	SEE Marks	6
Credits	04	Exam Hours	0

Course Learning Objectives:

- To introduce the per unit system and explain its advantages and computation.
- To explain the concept of one line diagram and its implementation in problems.
- To explain the necessity and conduction of short circuit analysis.
- To explain analysis of three phase symmetrical faults on synchronous machine and simple power systems.
- To discuss selection of circuit breaker.
- To explain symmetrical components, their advantages and the calculation of symmetrical components of voltages and currents in un-balanced three phase circuits.
- To explain the concept of sequence impedance and its analysis in three phase unbalanced circuits.
- To explain the concept of sequence networks and sequence impedances of an unloaded synchronous generator, transformers and transmission lines.
- To explain the analysis of synchronous machine and simple power systems for different unsymmetrical faults using symmetrical components.
- To discuss the dynamics of synchronous machine and derive the power angle equation for a synchronous machine.
- Discuss stability and types of stability for a power system and the equal area criterion for the evaluation of stability of a simple system. ■

Module-1

Representation of Power System Components: Introduction, Single-phase Representation of Balanced Three Phase Networks, One-Line Diagram and Impedance or Reactance Diagram, Per Unit (PU) System, Steady State Model of Synchronous Machine, Power Transformer, Transmission of Electrical Power, Representation of Loads. ■

Module-2

Symmetrical Fault Analysis: Introduction, Transient on a Transmission Line, Short Circuit of a Synchronous Machine(On No Load), Short Circuit of a Loaded Synchronous Machine, Illustrative simple examples on power systems. Selection of Circuit Breakers. ■

Module-3

Symmetrical Components: Introduction, Symmetrical Component Transformation, Phase Shift in Star-Delta Transformers, Sequence Impedances of Transmission Lines, Sequence Impedances and Sequence Network of Power System, Sequence Impedances and Networks of Synchronous Machine, Sequence Impedances of Transmission Lines, Sequence Impedances and Networks of Transformers, Construction of Sequence Networks of a Power System. ■

Module-4

Unsymmetrical Fault Analysis: Introduction, Symmetrical Component Analysis of Unsymmetrical Faults, Single Line-To-Ground (LG) Fault, Line-To-Line (LL) Fault, Double Line-To-Ground (LLG) Fault, Open Conductor Faults. ■

Module-5

Power System Stability: Introduction, Dynamics of a Synchronous Machine, Review of Power Angle Equation, Simple Systems, Steady State Stability, Transient Stability, Equal Area Criterion, Factors Affecting Transient Stability, Multi machine stability studies, classical representation. ■

Course Outcomes: At the end of the course the student will be able to:

- Model the power system components & construct per unit impedance diagram of power system.
- Analyze three phase symmetrical faults on power system.
- Compute unbalanced phasors in terms of sequence components and vice versa, also develop sequence networks.
- Analyze various unsymmetrical faults on power system.
- Examine dynamics of synchronous machine and determine the power system stability. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1.	Elements of Power System	William D. StevensonJr	McGraw Hill	4th Edition, 1982

Reference Books

1	Modern Power System	D. P. Kothari	McGraw Hill	4th Edition, 2011
2	Power System Analysis and Design	J.Duncan Glover et al	Cengage	4th Edition, 2008
3	Power System Analysis	Hadi Sadat	McGraw Hill	1st Edition, 2002

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
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SEMESTER - VI

DIGITAL SIGNAL PROCESSING (Core Subject)

Course Code	18EE63	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

- To define Discrete Fourier transform and its properties.
- To evaluate DFT of various signals using properties of DFT.
- To explain different linear filtering techniques.
- To explain the evaluation of DFT and inverse DFT using fast and efficient algorithms
- To discuss impulse invariant transformation, bilinear transformation techniques and their properties.
- To design infinite impulse response Butterworth digital filters using impulse invariant and bilinear transformation techniques.
- To design infinite impulse response Chebyshev digital filters using impulse invariant and bilinear transformation techniques.
- To discuss direct, cascade, parallel and ladder methods of realizing a digital IIR filter.
- To discuss window functions used for the design of FIR filters.
- To discuss windowing technique of designing FIR filter.
- To discuss frequency sampling technique of designing FIR filter.
- To discuss direct, cascade and linear phase form of realizing a digital FIR filter.

Module-1

Discrete Fourier Transforms: Definitions, properties-linearity, shift, symmetry Properties- circular convolution – periodic convolution, use of tabular arrays, circular arrays, Stock ham's method, linear convolution – two finite duration sequence, one finite & one infinite duration, overlap add and save methods.

Module-2

Fast Fourier Transforms Algorithms: Introduction, decimation in time algorithm, first decomposition, number of computations, continuation of decomposition, number of multiplications, computational efficiency, decimation in frequency algorithms, Inverse radix – 2 algorithms.

Module-3

Design of IIR Digital Filters: Introduction, impulse invariant transformation, bilinear transformations, All pole analog filters- Butterworth & Chebyshev filters, design of digital Butterworth filter by impulse invariant transformation and bilinear transformation, Frequency transformations.

Module-4

Design of IIR Digital Filters (Continued): Design of digital Chebyshev –type 1filter by impulse invariant transformation and bilinear transformation, Frequency transformations.

Realization of IIR digital systems: direct form, cascade form and parallel form, Ladder structures for equal degree polynomial.

Design of FIR Digital Filters: Introduction, windowing, rectangular, modified rectangular. Hamming, Hanning, Blackman window, design of FIR digital filters by use of windows, Design of FIR digital filters-frequency sampling techniques.

Realization of FIR systems: direct form, cascade form, linear phase form.

Course Outcomes: At the end of the course the student will be able to:

- Apply DFT and IDFT to perform linear filtering techniques on given sequences to determine the output.
- Apply fast and efficient algorithms for computing DFT and inverse DFT of a given sequence
- Design and realize infinite impulse response Butterworth and Chebyshev digital filters using impulse invariant and bilinear transformation techniques.
- Develop a digital IIR filter by direct, cascade, parallel, ladder and FIR filter by direct, cascade and linear phase methods of realization.
- Design and realize FIR filters by use of window function and frequency sampling method.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question)from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Book

1	Introduction to Digital Signal Processing	Jhonny R. Jhonson	Pearson	1st Edition, 2016

Reference Books

1.	Digital Signal Processing – Principles, Algorithms, and	Jhon G. Proakis Dimitris G. Manolakis	Pearson	4th Edition, 2007.
2.	Digital Signal Processing	A.NagoorKani	McGraw Hill	2nd Edition, 2012
3	Digital Signal Processing	Shaila D. Apte	Wiley	2nd Edition, 2009
4	Digital Signal Processing	Ashok Amberdar	Cengage	1st Edition, 2007
5	Digital Signal Processing	Tarun Kumar Rawat	Oxford	1st Edition, 2015

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
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SEMESTER - VI

INTRODUCTION TO NUCLEAR POWER (PROFESSIONAL ELECTIVE)

Course Code	**18EE641**	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:2:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To explain the fission process in nuclear materials and how the nuclear reactors work and the basic components of nuclear reactors and their types.
- Explanation about cooling of reactors, features of coolant, different types of coolants used in the reactors and the losses of cooling.
- Discussion on loss of cooling accidents in different reactors.
- Discussion on postulated severe accidents in water cooled reactors and other reactors and cooling of reactor during removal and processing.
- Discussion on cooling and disposing the nuclear waste and prospect of fusion energy in the future. ■

Module-1

The Earth and Nuclear Power: Sources and Resources: Introduction, Earth's Internal Heat Generation, The Earth's Energy Flow, The Fission Process, Thermal Energy Resources.
How Reactors Work: Introduction, The Fission Process, Basic Components of a Nuclear Reactor, Thermal Reactors, Fast Reactors. ■

Module-2

Cooling Reactors: Introduction, General Features of a Reactor Coolant, Principles of Heat Transfer, Gaseous Coolants, Liquid Coolants, Boiling Coolants.
Loss of Cooling: Introduction, The Electric Kettle, Pressurized-Water Reactor, Boiling-Water Reactor, CANDU Reactor, Gas-Cooled Reactors, Sodium- Cooled Fast Reactor. ■

Module-3

Loss-of-Cooling Accidents: Introduction, Incidents in light Water-Cooled Reactors, Heavy Water-Moderated Reactors, Gas-Cooled Reactors, Liquid Metal-Cooled Fast Reactors. ■

Module-4

Postulated Severe Accidents Introduction: Introduction, Postulated Severe Accidents in Water-Cooled Reactors, Specific Phenomena relating to Severe Accidents, Severe Accidents in other Reactor Types, Fission Product Dispersion following Containment Failure.
Cooling during Fuel Removal and Processing: Introduction, Refuelling, Spent Fuel Storage and Transport, Reprocessing Plant. ■

Module-5

Cooling and Disposing of the Waste: Introduction, Classification of Waste Products, Fission Products and Their Biological Significance, Options for Nuclear Waste Disposal, Long-Term Storage and Disposal of Spent Nuclear Fuel, Storage and Disposal of Fission Products from Reprocessing Plants, Disposal of other Materials.
Fusion Energy -Prospect for the Future: Introduction, The Fusion Process, Confinement, Current Technical Position, Conclusions. ■

Course Outcomes:

At the end of the course the student will be able to:

- Explain the fission process in nuclear materials, basic components of nuclear reactors, types of nuclear reactors and their working.
- List different types of coolants, their features, and cooling of reactors,
- Summarize loss of cooling accidents in different reactors.
- Discuss postulated severe accidents in reactors and cooling of reactor during removal of spent fuel.
- Discuss cooling and disposing the nuclear waste and prospect of fusion energy in the future.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Book

1	Introduction to Nuclear Power	Geoffrey F. Hewitt	Taylor & Francis	1st Edition, 2000

Reference Books

1	Nuclear Reactor Engineering	G.Vaidyanathan	S.Chand	1st Edition, 2013
2	Introduction to Nuclear Engineering	John R Lamarsh Anthony J Baratta	Pearson	3rd Edition, 2016

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SEMESTER - VI

ELECTRICAL ENGINEERING MATERIALS (Professional Elective)

Course Code	18EE642	CIE Marks	4
Number of Lecture Hours/Week LTP(L:T:P)	3:0:0	SEE Marks	6
Credits	03	Exam Hours	0

Course Learning Objectives:

- To impart the knowledge of conducting, dielectric, insulating and magnetic materials and their applications.
- To impart the knowledge of superconducting materials and their applications

Module-1

Introduction to Electrical and Electronic Materials: Importance of materials, Classification of electrical and electronic materials, Scope of electrical and electronic materials, Requirement of Engineering materials, Operational requirements of electrical and electronic materials, Classification of solids on the basis of energy gap, Products – working principle and materials, Types of engineering materials, Levels of material structure. Spintronics and Spintronic materials, Ferromagnetic semiconductors, Left handed materials.

Conductors: Conductor materials, Factors affecting conductivity, Thermal conductivity, Heating effect of current, Thermoelectric effect, Seebeck effect, Thomson effect, Wiedemann – Franz law and Lorentz relation, Problems . ■

Module-2

Conductive Materials and Applications: Mechanically processed forms of electrical materials, Types of conducting materials, Low resistivity materials, High resistivity materials, Contact materials, Fusible materials, Filament materials, Carbon as filamentary and brush material, Material for conductors, cables, wires, solder, sheathing and sealing.

Dielectrics: Introduction to dielectric materials, classification of dielectric materials, Dielectric constant, Dielectric strength and Dielectric loss. Polarization, Mechanisms of polarization, Comparison of different polarization process, Factors affecting polarization, Spontaneous polarization, Behavior of polarization under impulse and frequency switching, Decay and build-up of polarization under ac field, Complex dielectric constant. ■

Module-3

Insulating Materials: Insulating materials and applications – Ceramic, Mica, Porcelain, Glass, Micanite and Glass bonded mica. Polymeric materials – Bakelite, Polyethylene. Natural and synthetic rubber. Paper. Choice of solid insulating material for different applications, Liquid insulating materials – Requirements, Transformer oil, Bubble theory, Aging of mineral insulating oils. Gaseous insulating Materials – Air, Nitrogen, Vacuum.

Magnetic Materials: Origin of permanent magnetic dipole, Magnetic terminology, Relation between relative permeability and magnetic susceptibility. Classification of magnetic materials, Diamagnetic, Paramagnetism, Ferromagnetism, Antiferromagnetism and the corresponding materials. Ferrimagnetism and ferrites – properties and applications, Soft and hard ferrites. Curie temperature, Laws of magnetic materials. Magnetization curve, Initial and maximum permeability. Hysteresis loop and loss, Eddy current loss. ■

Module-4

Magnetic Materials (continued): Types of magnetic materials, Soft and hard magnetic materials, High energy magnetic materials, Commercial grade soft and hard magnetic materials.

Superconductive Materials: Concept of superconductors, Meaning of phenomenon of superconductivity, Properties of superconductors, Types of superconductors, Critical magnetic field

Module-4

Superconductive Materials (continued):and critical temperature, Effects of Isotopic mass on critical temperature, Silsbee rule, Depth of penetration and coherence length. Ideal and Hard superconductors, Mechanism of super conduction, London's theory for Type I superconductors, GLAG theory for Type I superconductors, BCS theory, Applications and limitations. Applications of high temperature superconductors, Superconducting solenoids and magnets, MRI for medical diagnostics. ■

Module-5

Plastics: Introduction, Thermoplastics, Rubbers, Thermosets, DC and AC properties, Mechanical properties and processing of plastic.
Materials for Opto – Electronic Devices: Introduction, Optical phenomena, Reflection, Refraction, Transmittivity, Scattering, Optical absorption, Optical properties of non-metals, Optical properties of metals, Optical properties of semiconductors, Optical properties of insulators. Luminescence, Opto – Electronic devices, Photoconductivity, Photoconductive cell.

Course Outcomes: At the end of the course the student will be able to:

- Discuss electrical and electronics materials, their importance, classification and operational requirement
- Discuss conducting, dielectric, insulating and magnetic materials used in engineering, their properties and classification.
- Explain the phenomenon superconductivity, super conducting materials and their application in engineering.
- Explain the plastic and its properties and applications

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Book

1	Advanced Electrical and Electronics Materials; Processes and	K.M. Gupta Nishu Gupta	Wiley	First Edition, 2015

Reference Books

1	Electronic Engineering Materials	R.K. Shukla Archana Singh	McGraw Hill	2012
2	Electrical Properties of Materials	L Solymar et al	Oxford	9th Edition, 2014
3	Electrical Engineering Materials	A.J. Dekker	Pearson	2016
4	Principle of Electronic Materials and Devices	S.O. Kasap	McGraw Hill	3rd Edition 2010

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SEMESTER - VI

COMPUTER AIDED ELECTRICAL DRAWING (PROFESSIONAL

Course Code	18EE643	CIE Marks	40
Number of Lecture Hours/Week(L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To discuss the terminology of DC and AC armature windings.
- To discuss design and procedure to draw armature winding diagrams for DC and AC machines.
- To discuss the substation equipment, their location in a substation and development of a layout for substation.
- To discuss different sectional views of transformers, DC machine, its parts and alternator and its parts.
- To explain development of sectional views of Transformers, DC machine and alternators using the design data, sketches. ■

Suitable CAD software can be used for drawings

PART - A

Module-1

Winding Diagrams:
(a) Developed Winding Diagrams of D.C. Machines: Simplex Double Layer Lap and Wave Windings.
(b) Developed Winding Diagrams of A.C. Machines:
(c)Integral and Fractional Slot Double Layer Three Phase Lap and Wave Windings.
(d) Single Layer Windings – Un-Bifurcated 2 and 3 Tier Windings, Mush Windings, Bifurcated 3 Tier Windings. ■

Module-2

Single Line Diagrams: Single Line Diagrams of Generating Stations and Substations Covering Incoming Circuits, Outgoing Circuits, Busbar Arrangements (Single, Sectionalised Single, Main and Transfer, Double Bus Double Breaker, Sectionalised Double Bus, One and a Half Circuit Breaker Arrangement, Ring Main),Power Transformers, Circuit Breakers, Isolators, Earthing Switches, Instrument Transformers, Surge or Lightning Arresters, Communication Devices (Power- Line Carrier) and Line Trap. ■

PART - B

Module-3

Electrical Machine Assembly Drawings Using Design Data, Sketches or Both:
Transformers - Sectional Views Of Single And Three Phase Core And Shell Type Transformers. ■

Module-4

Electrical Machine Assembly Drawings Using Design Data, Sketches or Both:
D.C. Machine - Sectional Views of Yoke with Poles, Armature and Commutator dealt separately. ■

Module-5

Electrical Machine Assembly Drawings Using Design Data, Sketches or Both:
Alternator – Sectional Views of Stator and Rotor dealt separately. ■

Course Outcomes: At the end of the course the student will be able to**:**

- Develop armature winding diagram for DC and AC machines
- Develop a Single Line Diagram of Generating Stations and substation using the standard symbols.
- Construct sectional views of core and shell types transformers using the design data
- Construct sectional views of assembled DC and AC machine and their parts using the design data or the sketches■

Question paper pattern:

- The question paper will have two parts, PART – A and PART – B.
- Each part is for 50 marks.
- Part A is for Modules 1 and 2.
- Questions 1 and 2 of PART - A will be only on DC windings or only on AC windings. Students have to answer any one of them. The marks prescribed is 25.
- Question 3 of PART – A covering module 2 is compulsory. The marks prescribed is 15.
- Part B is for Modules 3, 4 and 5.
- Questions 4 and 5 will cover any two modules of modules 3, 4 and 5. Students have to answer any one of them. The marks prescribed is 40.

Reference Books

1	A course in Electrical Machine design	A. K. Sawhney	DhanpatRai	6th Edition, 2013
2	Electrical Engineering Drawing	K. L. Narang	Satya Prakashan	2014

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Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

EMBEDDED SYSTEMS (PROFESSIONAL ELECTIVE)

Course Code	18EE644	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To understand the concepts of Embedded system design such as ROM variants, RAM, SOC
- To learn the technological aspects of Embedded system such as signal conditioning, Sample & Hold.
- To understand the design trade offs.
- To study about the software aspects of Embedded system.

Module-1

Concept of Embedded System Design: Components, classification, skills required. Embedded Micro controller cores: Architecture of 6808 and 6811.Embedded Memories ROM variants, RAM. ■**T3 and R3**

Module-2

Technological Aspects of Embedded System: Applications of embedded system: Examples of Embedded systems SOC for bar code scanner. Interfacing between analog and digital blocks, Signal conditioning, digital signal processing, DAC & ADC interfacing, Sample & hold, multiplexer interface Internal ADC interfacing (excluding 6805 & 6812). ■**T1**

Module-3

Design Trade Offs Due to Process Incompatibility, Thermal Considerations: Data Acquisition System and Signal conditioning using DSP . Issues in embedded system design. Design challenge, design technology, trade offs. Thermal considerations. ■ **R1 and Internet Sources**

Module-4

Software aspects of Embedded Systems: Real time programming Languages, operating systems. Programming concepts and embedded programming in C. Round Robin, Round Robin with interrupts, function queue-scheduling architecture. ■**T3 and R3**

Module-5

Subsystem interfacing: With external systems user interfacing, Serial I/O devices, Parallel port interfaces: Input switches, Key boards and Memory interfacing. ■**T1**

Course Outcomes: At the end of the course the student will be able to:

- Identify the Embedded system components.
- Apply technological aspects to various interfacing with devices.
- Elaborate various design tradeoffs.
- Apply software aspects and programming concepts to the design of Embedded System.
- Explain how to interface subsystems with external systems. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books:

1	Embedded Microcomputer systems: Real time interfacing	Valvano, J.W	Cengage Learning,	2nd Edition 5th Indian
2	The Art of Designing Embedded systems- Ganssle,	Jack, Newness		

3	Embedded System, Architecture, Programming and	Raj Kamal	TMH,	2nd Edition
Reference Books:				
1	A Unified Hardware/Software Introduction	Frank Vahid/Tony Givargis	Wiley student edition	2002
2	Motorola and Intel Manuals			
3	Embeded Software Premier	Simon David	Addison Wessly	2000

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

OBJECT ORIENTED PROGRAMMING USING C++ (PROFESSIONAL ELECTIVE)

Subject Code	**18EE64**	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	03	SEE Marks	60
Credits	40	Exam Hours	03

Course Learning Objectives:
This course will enable students to:

- Define Encapsulation, Inheritance and Polymorphism.
- Solve the problem with object oriented approach.
- Analyze the problem statement and build object oriented system model.
- Describe the characters and behavior of the objects that comprise a system.
- Explain function overloading, operator overloading and virtual functions.
- Discuss the advantages of object oriented programming over procedure oriented programming. ■

Module-1

Beginning with C++ and its Features:
What is C++?, Applications and structure of C++ program, Different Data types, Variables, Different Operators, expressions, operator overloading and control structures in C++ . ■ (Topics from Ch -2,3 of T1).

Module-2

Functions, Classes and Objects:
Functions, Inline function, function overloading, friend and virtual functions, Specifying a class, C++ program with a class, arrays within a class, memory allocation to objects, array of objects, members, pointers to members and member functions. ■ (Selected Topics from Chap-4,5 of T1).

Module-3

Constructors, Destructors and Operator Overloading: Constructors, Multiple constructors in a class, Copy constructor, Dynamic constructor, Destructors, Defining operator overloading, Overloading Unary and binary operators, Manipulation of strings using operators. ■ (Selected topics from Chap-6, 7 of T1).

Module-4

Inheritance, Pointers, Virtual Functions, Polymorphism:
Derived Classes, Single, multilevel, multiple inheritance, Pointers to objects and derived classes, this pointer, Virtual and pure virtual functions (Selected topics from Chap-8,9 of Text).

Streams and Working with Files:
C++ streams and stream classes, formatted and unformatted I/O operations, Output with manipulators, Classes for file stream operations, opening and closing a file, EOF (Selected topics from Chap- 10, 11 of Text).

Course Outcomes: At the end of the course the student will be able to:

- Explain the basics of Object Oriented Programming concepts.
- Apply the object initialization and destroy concept using constructors and destructors.
- Apply the concept of polymorphism to implement compile time polymorphism in programs by using overloading methods and operators.
- Utilize the concept of inheritance to reduce the length of code and evaluate the usefulness.
- Apply the concept of run time polymorphism by using virtual functions, overriding functions and abstract class in programs.
- Utilize I/O operations and file streams in programs. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books				
1	ObjectOriented Programming with C++	E.Balaguruswamy, TMH	TMH	6th Edition, 2013
Reference Books				
1	ObjectOriented Programming with C++	Robert Lafore	Galgotia publication	2010
2	ObjectOriented Programming with C++	Sourav Sahay	Oxford University	2006

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER – VI			
CONTROL SYSTEM LABORATORY			
Course Code	**18EEL66**	CIE Marks	40
Number of Practical Hours/Week(L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To determine the time and frequency domain reposes of a given second order system using software package or discrete components.
- To design and analyze Lead, Lag and Lag – Lead compensators for given specifications.
- To draw the performance characteristics of ac and DC servomotors and synchro-transmitter receiver pair.
- To study the DC position & feedback control system and to study the effect of P, PI, PD and PID controller and Lead compensator on the step response of the system.
- To write a script files to plot root locus, bode plot, to study the stability of the system using a

Sl. NO	Experiments
1	Experiment to draw the speed torque characteristics of (i) AC servo motor (ii) DC servo motor
2	Experiment to draw synchro pair characteristics
3	Experiment to determine frequency response of a second order system
4	(a) To design a passive RC lead compensating network for the given specifications, viz, the maximum phase lead and the frequency at which it occurs and to obtain the frequency response.
5	(a) To design a passive RC lag compensating network for the given specifications, viz, the maximum phase lag and the frequency at which it occurs and to obtain the frequency response. (b) To determine experimentally the transfer function of the lag compensating network
6	Experiment to draw the frequency response characteristics of the lag – lead compensator network and determination of its transfer function.
7	To study a second order system and verify the effect of (a) P, (b) PI, (c) PD and (d) PID controller on the step response.
8	(a) To simulate a typical second order system and determine step response and evaluate time response specifications. (b) To evaluate the effect of adding poles and zeros on time response of second order system. (c) To evaluate the effect of pole location on stability
9	(a) To simulate a D.C. Position control system and obtain its step response. (b) To verify the effect of input waveform, loop gain and system type on steady state errors. (c) To perform trade-off study for lead compensator. (d) To design PI controller and study its effect on steady state error.
10	(a) To examine the relationship between open-loop frequency response and stability, open-loop frequency and closed loop transient response (b) To study the effect of open loop gain on transient response of closed loop system using root locus.
11	(a) To study the effect of open loop poles and zeros on root locus contour (b) Comparative study of Bode, Nyquist and root locus with respect to stability.

Note:

Sl. NO	Description	Experiment numbers
1	Perform experiments using suitable components/equipment's	1 & 2
2	Perform experiments using suitable components/equipment's and verify the results using standard simulation package	3,4,5,6 and 7
3	Perform simulation only using standard package	8,9,10 and 11

Course Outcomes: At the end of the course the student will be able to:

- Utilize software package and discrete components in assessing the time and frequency domain response of a given second order system.
- Design, analyze and simulate Lead, Lag and Lag – Lead compensators for given specifications.
- Determine the performance characteristics of ac and DC servomotors and synchro-transmitter receiver pair used in control systems.
- Simulate the DC position and feedback control system to study the effect of P, PI, PD and PID controller and Lead compensator on the step response of the system.
- Develop a script files to plot Root locus, Bode plot and Nyquist plot to study the stability of

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER -VI

DIGITAL SIGNAL PROCESSING LABORATORY

Course Code	**18EEL67**	CIE Marks	40
Number of Practical Hours/Week(L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To explain the use of MATLAB/Scilab/Python software in evaluating the DFT and IDFT of given sequence
- To verify the convolution property of the DFT
- To design and implementation of IIR and FIR filters for given frequency specifications.
- To realize IIR and FIR filters.
- To help the students in developing software skills. ■

Sl. No	Experiments
1	Verification of Sampling Theorem both in time and frequency domains
2	Evaluation of impulse response of a system
3	To perform linear convolution of given sequences
4	To perform circular convolution of given sequences using (a) the convolution summation formula (b)
5	Computation of N – point DFT and to plot the magnitude and phase spectrum.
6	Linear and circular convolution by DFT and IDFT method.
7	Solution of a given difference equation.
8	Calculation of DFT and IDFT by FFT
9	Design and implementation of IIR filters to meet given specification (Low pass, high pass, band pass and band reject filters)
10	Design and implementation of FIR filters to meet given specification (Low pass, high pass, band pass and band reject filters) using different window functions
11	Design and implementation of FIR filters to meet given specification (Low pass, high pass, band pass and band reject filters) using frequency sampling technique.
12	Realization of IIR and FIR filters

Course Outcomes:

At the end of the course the student will be able to:

- Explain physical interpretation of sampling theorem in time and frequency domains.
- Evaluate the impulse response of a system.
- Perform convolution of given sequences to evaluate the response of a system.
- Compute DFT and IDFT of a given sequence using the basic definition and/or fast methods.
- Provide a solution for a given difference equation.
- Design and implement IIR and FIR filters. ■

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■

VII SEMESTER DETAILED SYLLABUS

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII

POWER SYSTEM ANALYSIS – 2(Core Course)

Course Code	**18EE71**	CIE Marks	40
Number of Lecture Hours/Week	2:2:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To explain formulation of network models and bus admittance matrix for solving load flow problems.
- To discuss optimal operation of generators on a bus bar and optimum generation scheduling.
- To explain symmetrical fault analysis and algorithm for short circuit studies.
- To explain formulation of bus impedance matrix for the use in short circuit studies on power systems.
- To explain numerical solution of swing equation for multi-machine stability

Module-1

Network Topology: Introduction and basic definitions of Elementary graph theory Tree, cut-set, loop analysis. Formation of Incidence Matrices. Primitive network- Impedance form and admittance form, Formation of Y Bus by Singular Transformation. Y_{bus} by Inspection Method. Illustrative examples. ■ T1,2

Module-2

Load Flow Studies: Introduction, Classification of buses. Power flow equation, Operating Constraints, Data for Load flow, Gauss Seidal iterative method. Illustrative examples. ■ T1, R1

Module-3

Load Flow Studies(continued) Newton-Raphson method derivation in Polar form, Fast decoupled load flow method, Flow charts of LFS methods. Comparison of Load Flow Methods. Illustrative examples.■ T1, R1

Module-4

Economic Operation of Power System: Introduction and Performance curves Economic generation scheduling neglecting losses and generator limits Economic generation scheduling including generator limits and neglecting losses Economic dispatch including transmission losses Derivation of transmission loss formula. Illustrative examples.T1

Unit Commitment: Introduction, Constraints and unit commitment solution by prior list method and dynamic forward DP approach (Flow chart and Algorithm only). ■ T3

Module-5

Symmetrical Fault Analysis: Z Bus Formulation by Step by step building algorithm without mutual coupling between the elements by addition of link and addition of branch. Illustrative examples.Z bus Algorithm for Short Circuit Studies excluding numerical.T1

Power System Stability: Numerical Solution of Swing Equation by Point by Point method and Runge Kutta Method. Illustrative examples. ■ T1

Course Outcomes: At the end of the course the student will be able to:

- Formulate network matrices and models for solving load flow problems.
- Perform steady state power flow analysis of power systems using numerical iterative techniques.
- Solve issues of economic load dispatch and unit commitment problems.
- Analyze short circuit faults in power system networks using bus impedance matrix.
- Apply Point by Point method and Runge Kutta Method to solve Swing Equation. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Module 1 Y_{Bus} Matrix size limited to 3X3 for illustrative examples.

Module 2 NR Method limited to 3 bus system with one iteration for illustrative examples.

Text Books

1	Modern Power System Analysis	D P Kothari, I J Nagrath	McGraw Hill	4th Edition, 2011
2	Computer Methods in Power Systems Analysis	Glenn W. Stagg Ahmed H Ei - Abiad	Scientific International Pvt. Ltd.	1st Edition, 2019
3	Power Generation Operation and Control	Allen J Wood etal	Wiley	2nd Edition,2016

Reference Books

1	Computer Techniques in Power System Analysis	M.A. Pai	McGraw Hill	2nd Edition, 2012
2	Power System Analysis	Hadi Saadat	McGraw Hill	2ndEdition, 2002

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SEMESTER – VII

POWER SYSTEM PROTECTION (Core Subject)

Course Code	**18EE72**	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To discuss performance of protective relays, components of protection scheme and relay terminology.
- To explain relay construction and operating principles.
- To explain Over current protection using electromagnetic and static relays and Over current protective schemes.
- To discuss types of electromagnetic and static distance relays, effect of arc resistance, power swings, line length and source impedance on performance of distance relays.
- To discuss pilot protection; wire pilot relaying and carrier pilot relaying.
- To discuss construction, operating principles and performance of various differential relays for differential protection.
- To discuss protection of generators, motors, Transformer and Bus Zone Protection.
- To explain the principle of circuit interruption and different types of circuit breakers.
- To describe the construction and operating principle of different types of fuses and to give the definitions of different terminologies related to a fuse.
- To discuss protection Against Over voltages and Gas Insulated Substation (GIS). ■

Module-1

Introduction to Power System Protection: Need for protective schemes, Nature and Cause of Faults, Types of Fault, Effects of Faults, Fault Statistics, Zones of Protection, Primary and Backup Protection, Essential Qualities of Protection, Performance of Protective Relaying, Classification of Protective Relays, Automatic Reclosing, Current Transformers for protection, Voltage Transformers for Protection.

Relay Construction and Operating Principles: Introduction, Electromechanical Relays, Static Relays – Merits and Demerits of Static Relays, Numerical Relays, Comparison between Electromechanical Relays and Numerical Relays.

Overcurrent Protection: Introduction, Time – current Characteristics, Current Setting, Time Setting. ■

Module-2

Overcurrent Protection (continued): Overcurrent Protective Schemes, Reverse Power or Directional Relay, Protection of Parallel Feeders, Protection of Ring Mains, Earth Fault and Phase Fault Protection, Combined Earth Fault and Phase Fault Protective Scheme, Phase Fault Protective Scheme, Directional Earth Fault Relay, Static Overcurrent Relays, Numerical Overcurrent Relays.

Distance Protection: Introduction, Impedance Relay, Reactance Relay, Mho Relay, Angle Impedance Relay, Effect of Arc Resistance on the Performance of Distance Relays, Reach of Distance Relays. Effect of Power Surges(Power Swings) on Performance of Distance Relays, Effect of Line Length and Source Impedance on Performance of Distance Relays. ■

Module-3

Pilot Relaying Schemes: Introduction, Wire Pilot Protection, Carrier Current Protection

Differential Protection: Introduction, Differential Relays, Simple Differential Protection, Percentage or Biased Differential Relay, Differential Protection of 3 Phase Circuits, Balanced (Opposed) Voltage Differential Protection.

Rotating Machines Protection: Introduction, Protection of Generators.

Transformer and Buszone Protection: Introduction, Transformer Protection, Buszone Protection, Frame Leakage Protection. ■

Module-4

Circuit Breakers: Introduction, Fault Clearing Time of a Circuit Breaker, Arc Voltage, Arc Interruption, Restriking Voltage and Recovery Voltage, Current Chopping, Interruption of Capacitive Current, Classification of Circuit Breakers, Air – Break Circuit Breakers, Oil Circuit Breakers, Air – Blast Circuit Breakers, SF_6 Circuit Breakers, Vacuum Circuit Breakers, High Voltage Direct Current Circuit Breakers, Rating of Circuit Breakers, Testing of Circuit Breakers. ■

Module-5

Fuses: Introductions, Definitions, Fuse Characteristics, Types of Fuses, Applications of HRC Fuses, Selection of Fuses, Discrimination.

Protection against Overvoltages: Causes of Overvoltages, Lightning phenomena, Wave Shape of Voltage due to Lightning, Over Voltage due to Lightning, Klydonograph and Magnetic Link, Protection of Transmission Lines against Direct Lightning Strokes, Protection of Stations and Sub – Stations from Direct Strokes, Protection against Travelling Waves, Insulation Coordination, Basic Impulse Insulation Level (BIL).

Modern Trends in Power System Protection: Introduction, gas insulated substation/switchgear (GIS). ■

Course Outcomes: At the end of the course the student will be able to:

- Discuss performance of protective relays, components of protection scheme and relay terminology over current protection.
- Explain the working of distance relays and the effects of arc resistance, power swings, line length and source impedance on performance of distance relays.
- Discuss pilot protection, construction, operating principles and performance of differential relays and discuss protection of generators, motors, transformer and Bus Zone Protection.
- Explain the construction and operation of different types of circuit breakers.
- Outline features of fuse, causes of overvoltages and its protection, also modern trends in Power System Protection. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books

1	Power System Protection and Switchgear	Badri Ram, D.N. Vishwakarma	McGraw Hill	2nd Edition
2	Power System Protection and Switchgear	BhuvaneshOza et al	McGraw Hill	1st Edition, 2010

Reference Books

1	Protection and Switchgear	Bhavesh et al	Oxford	1st Edition, 2011
2	Power System Switchgear and Protection	N. Veerappan S.R. Krishnamurthy	S. Chand	1st Edition, 2009
3	Fundamentals of Power System Protection	Y.G.Paithankar S.R. Bhide	PHI	1st Edition, 2009

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII

SOLAR AND WIND ENERGY (Professional Elective)

Course Code	**18EE731**	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To discuss the importance of energy in human life, relationship among economy and environment with energy use.
- To discuss the increasing role of renewable energy, energy management, energy audit, energy efficiency, energy intensity.
- To discuss energy consumption status in India, energy saving potential and energy conservation efforts in India.
- To explain the concept of energy storage and the principles of energy storage devices.
- To discuss the characteristics and distribution of solar radiation, measurement of components of solar radiation and analysis of collected solar radiation data.
- To explain availability of solar radiation at a location and the effect of tilting the surface of collector with respect to horizontal surface.
- To describe the process of harnessing solar energy in the form of heat and working of solar collectors.
- To discuss applications of solar energy including heating and cooling.
- To discuss the operation of solar cell and the environmental effects on electrical characteristics of solar cell
- To discuss sizing and design of typical solar PV systems and their applications.
- To discuss basic Principles of Wind Energy Conversion and to compute the power available in the wind.
- To discuss forces on the Blades, Wind Energy Conversion, collection of Wind Data, energy estimation and site selection.
- To discuss classification of WEC Systems, its advantages and disadvantages of WECS, and Types of Wind Machines (Wind Energy Collectors).
- To evaluate the performance of Wind-machines, Generating Systems. ∎

Module-1

Fundamentals of Energy Science and Technology: Introduction, Energy, Economy and Social Development, Classification of Energy Sources, Importance of Non -conventional Energy Sources, Salient features of Non-conventional Energy Sources, World Energy Status, Energy Status in India. **Energy Conservation and Efficiency:** Introduction, Important Terms and Definitions, Important Aspects of Energy Conservation, Global Efforts, Achievements and Future Planning, Energy Conservation/Efficiency Scenario in India, Energy Audit, Energy Conservation Opportunities.

Energy Storage: Introduction, Necessity of Energy Storage, Specifications of Energy Storage Devices. **Solar Energy-Basic Concepts:** Introduction, The Sun as Source of Energy, The Earth, Sun, Earth Radiation Spectrum, Extraterrestrial and Terrestrial Radiations, Spectral Power Distribution of Solar Radiation, Depletion of Solar Radiation. ∎

Module-2

Solar Energy-Basic Concepts (continued): Measurement of Solar Radiation, Solar Radiation Data, Solar Time, Solar Radiation Geometry, Solar Day Length, Extraterrestrial Radiation on Horizontal Surface, Empirical Equations for Estimating Terrestrial Solar Radiation on Horizontal Surface, Solar Radiation on Inclined Plane Surface.

Solar Thermal Systems: Introduction, Solar Collectors, Solar Water Heater, Solar Passive Space Heating and Cooling Systems, Solar Industrial Heating Systems, Solar Refrigeration and Air Conditioning Systems, Solar Cookers. ∎

Module-3
Solar Photovoltaic Systems: Introduction, Solar Cell Fundamentals, Solar Cell Characteristics, Solar Cell Classification, Solar Cell Technologies, Solar Cell, Module, and Array Construction, Maximizing the Solar PV Output and Load Matching. Maximum Power Point Tracker. Balance of System Components, Solar PV Systems, Solar PV Applications. ■
Module-4
Wind Energy: Introduction, Basic Principles of Wind Energy Conversion, History of Wind Energy, Wind Energy Scenario – World and India. The Nature of the Wind, The Power in the Wind, Forces on the Blades, Wind Energy Conversion, Wind Data and Energy Estimation, Site Selection Considerations **Wind energy systems:** Environment and Economics Environmental benefits and problems of wind energy, Economics of wind energy, Factors influence the cost of energy generation, machine parameters, Life cycle cost analysis ■
Module-5
Basic Components of a Wind Energy Conversion(WEC) System: Classification of WEC systems, Advantages and Disadvantages of WECS, Types of Wind Machines (Wind Energy Collectors), Analysis of Aerodynamic Forces Acting on the Blade, Performance of Wind- machines, Generating Systems, Energy Storage, Applications of Wind Energy, Environmental Aspects. ■

Course Outcomes:

At the end of the course the student will be able to:

- Discuss the importance of the role of renewable energy, the concept of energy storage and the principles of energy storage devices.
- Discuss the concept of solar radiation data and solar PV system fabrication, operation of solar cell, sizing and design of PV system.
- Describe the process of harnessing solar energy and its applications in heating and cooling.
- Explain basic Principles of Wind Energy Conversion, collection of wind data, energy estimation and site selection.
- Discuss the performance of Wind-machines, energy storage, applications of Wind Energy and environmental aspects. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Textbook				
1	Non-Conventional Energy Resources	B. H. Khan	McGraw Hill	2nd Edition 2017
2	Non-Conventional Sources of Energy	Rai G. D.	Khanna Publishers	4th Edition, 2009
Reference Books				
1	Non-Conventional Energy Resources	ShobhNath Singh	Pearson	1st Edition, 2015
2	Solar Energy – Principles of Thermal Collections and Storage	S.P. Sukhatme J.K.Nayak	McGraw Hill	3rd Edition, 2008
3	Wind Turbine Technology	Ahmad Hemami	Cengage	1st Edition, 2012

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
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SEMESTER – VII

SENSORS AND TRANSDUCERS (Professional Elective)

Course Code	**18EE732**	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To discuss need of transducers, their classification, advantages and disadvantages.
- To discuss working of different types of transducers and sensors.
- To discuss recent trends in sensor technology and their selection.
- To discuss basics of signal conditioning and signal conditioning equipment.
- To discuss configuration of Data Acquisition System and data conversion. To discuss the basics of Data transmission and telemetry.
- To explain measurement of various non-electrical quantities.

Module-1

Sensors and Transducers: Introduction, Classification of Transducers**,** Advantages and Disadvantages of Electrical Transducers, Transducers Actuating Mechanisms, Resistance Transducers, Variable Inductance Transducers, Capacitive Transducers, Piezoelectric Transducers, Hall Effect Transducers, Thermoelectric Transducers, Photoelectric Transducers.

Module-2

Sensors and Transducers (continued): Stain Gages, Load Cells, Proximity Sensors, Pneumatic Sensors, Light Sensors, Tactile Sensors, Fiber Optic Transducers, Digital Transducers, Recent Trends – Smart Pressure Transmitters, Selection of Sensors, Rotary – Variable Differential Transformer, Synchros and Resolvers, Induction Potentiometers, Micro Electromechanical Systems.

Module-3

Signal Condition: Introduction, Functions of Signal Conditioning Equipment, Amplification, Types of Amplifiers, Mechanical Amplifiers Fluid Amplifiers, Optical Amplifiers, Electrical and electronic Amplifiers.
Data Acquisition Systems and Conversion: Introduction, Objectives and Configuration of Data Acquisition System, Data Acquisition Systems, Data Conversion.

Module-4

Data Transmission and Telemetry: Data/Signal Transmission, Telemetry.
Measurement of Non – Electrical Quantities: Pressure Measurement.

Module-5

Measurement of Non – Electrical Quantities (continued): Temperature Measurement, Flow Measurement – Introduction, Electromagnetic Flow meters, Ultrasonic Flow Meters, Thermal Metes, Wire Anemometers. Measurement of Displacement, Measurement of Velocity/ Speed, Measurement of Acceleration, Measurement of Force, Measurement of Torque, Measurement of Shaft Power, Measurement of Liquid Level, Measurement of Viscosity.

Course Outcomes: At the end of the course the student will be able to:

- Classify the transducers and explain the need of transducers, their classification, advantages and disadvantages.
- Explain the working of various transducers and sensors.
- Outline the recent trends in sensor technology and their selection.
- Analyze the signal conditioning and signal conditioning equipment.
- Illustrate different configuration of Data Acquisition System and data conversion.
- Show knowledge of data transmission and telemetry.
- Explain measurement of non-electrical quantities -temperature, flow, speed, force, torque, power and viscosity. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	Electrical and Electronic Measurements and instrumentation	R.K Rajput	S. Chand	3rd Edition, 2013.

Reference Books

1	A Course in Electronics and Electrical Measurements and Instruments	J.B. Gupta	Katson Books	13th Edition, 2008
2	A Course in Electrical and Electronic Measurements and Instrumentation	A. K. Sawheny	DhanpatRai	2015

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER – VII			
INTEGRATION OF DISTRIBUTED GENERATION(Professional Elective)			
Course Code	**18EE733**	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To explain power generation by alternate energy source like wind power and solar power.
- To explain selection of size of units and location for wind and solar systems.
- Discuss the effects of integration of distributed generation on the performance the system.
- To provide practical and useful information about grid integration of distributed generation.

Module-1

Distributed Generation: Introduction, status, Properties of wind power, Power Distribution as a function of wind speed, Solar Power: Status, Properties, Space requirements, Photovoltaic's, Seasonal variation in production capacity, Combined Heat-and-Power: Status, Options for space Heating, Hydropower: Properties of Large Hydro, Properties of small Hydro, Variation with time, Tidal Power, Wave Power, Geothermal Power, Thermal Power Plant. ■

Module-2

Distributed Generation(continued): Interface with the Grid. Power System Performance: Impact of Distributed Generation on the Power System, Aims of the Power System, Hosting Capacity Approach, Power Quality, Voltage Quality and Design of Distributed Generation, Hosting Capacity Approach for Events, Increasing the Hosting Capacity. Overloading and Losses: Impact of Distributed Generation, Overloading: Radial Distribution Networks, Active Power Flow Only, Active and Reactive Power Flow Overloading: Redundancy and Meshed Operation Redundancy in Distribution Networks Meshed Operation, Losses.■

Module-3

Over loading and Losses (continued): Increasing the Hosting Capacity: Increasing the Loadability Building New Connections, Inter trip Schemes, Advanced protection Schemes, Energy Management Systems. Power Electronics approach, Demand Control, Prioritizing Renewable Energy, Dynamic Loadability.

Voltage Magnitude Variations: Impact of Distributed Generation, Voltage Marginand Hosting Capacity: Voltage Control in Distribution Systems, Voltage Rise Owing to Distributed Generation, Hosting Capacity, Estimating hosting capacity without Measurements, Sharing hosting capacity. Design of Distribution Feeders: Basic Design Rules, Terminology, An Individual Generator Along a Medium-Voltage Feeder, Low voltage feeders, Series and Shunt Compensation, A Numerical Approach to Voltage Variations: Example for Two-stage Boosting, General Expressions for Two-Stage Boosting Tap Changers with Line- Drop Compensation: Transformer with One Single Feeder, Adding a Generator.ProbabilisticMethodsforDesignofDistributionFeeders:Need for Probabilistic Methods, The System Studied, Generation with Constant Production, Adding Wind Power■

Module-4

VoltageMagnitudeVariations(continued): StatisticalApproachtoHostingCapacity,IncreasingtheHostingCapacity: New or Stronger Feeders, Alternative Methods for Voltage Control Accurate Measurement of the Voltage Magnitude Variations, Allowing Higher Overvoltage's Overvoltage Protection, Over Voltage Curtailment Compensating the generators voltage variations, Distributed generation with voltage control, Coordinated voltage control.

Power Quality Disturbances: Impact of Distributed Generation, Fast Voltage Fluctuations: Fast Fluctuations in Wind Power, Fast Fluctuations in Solar Power, Rapid Voltage Changes, Very Short Variations. Voltage Unbalance :Weaker Transmission System, Stronger Distribution System, Large Single-Phase Generators, Stronger Distribution Grid VoltageUnbalance. ■

Module-5

Power Quality Disturbances(continued): Low-Frequency Harmonics: Wind Power: Induction Generators, Generators with Power Electronics Interfaces, Synchronous Generators, Measurement Example, Harmonic Resonances, Weaker Transmission Grid, Stronger Distribution Grid. High-Frequency Distortion: Emission by Individual Generators, Grouping Below and Above 2 kHz, Limits Below and Above 2 kHz,Voltage Dips: Synchronous Machines Balanced Dips and Unbalanced Dips, Induction generators and unbalanced dips. Increasing the Hosting Capacity: Strengthening the Grid, Emission Limits for Generator Units, Emission Limits for Other Customers, Higher Disturbance Levels, Passive Harmonic Filters, Power Electronics Converters, Reducing the Number of Dips, Broadband and High-Frequency Distortion. ■

Course Outcomes: At the end of the course the student will be able to:

- Explain energy generation by wind power and solar power.
- Discuss the variation in production capacity at different time scales,the size of individual units, and the flexibility in choosing locations with respect to wind and solar systems.
- Explain the performance of the system when distributed generation is integrated to the system.
- Discuss effects of the integration of DG: the increased risk of overload, increased losses, increased risk of overvoltages and increased levels of power quality disturbances.
- Discuss effects of the integration of DG: incorrect operation of the protection.
- Discuss the impact the integration of DG on power system stability and operation. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	Integration of Distributed Generation in the Power System	Math Bollen	Wiley	2011

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII

ADVANCED CONTROL SYSTEMS (Professional Elective)

Course Code	**18EE734**	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To introduce state variable approach for linear time invariant systems in both the continuous and discrete time systems
- To explain development of state models for linear continuous – time and discrete – time systems To explain application of vector and matrix algebra to find the solution of state equations for linear
- continuous – time and discrete – time systems
- To define controllability and observability of a system and testing techniques for controllability and observability of a given system
- To explain design techniques of pole assignment and state observer using state feedback.
- To explain about inherent and intentional nonlinearities that can occur in control system and developing the describing function for the nonlinearities.
- To explain stability analysis of nonlinear systems using describing function analysis.
- To explain the analysis of nonlinear systems using Lyapunov function and design of Lyapunov function for stable systems.■

Module-1

State Variable Analysis and Design: Introduction, Concept of State, State Variables and State Model,StateModelsforLinearContinuous–TimeSystems,StateVariablesandLinearDiscrete–Time Systems.■

Module-2

State Variable Analysis and Design (continued): Diagonalization, Solution of State Equations, Concepts of Controllability and Observability.■

Module-3

Pole Placement Design and State Observers: Introduction, Stability Improvements by State Feedback, Necessary and Sufficient Conditions for Arbitrary Pole Placement, State Regulator Design, Design of State Observer, Compensator Design by the Separation Principle.■

Module-4

Non-linear systems Analysis: Introduction, Common Nonlinear System Behaviours, Common Nonlinearities in Control Systems, Fundamentals, Describing Functions of Common Nonlinearities, Stability Analysis by Describing Function Method, Concept of Phase Plane Analysis, Construction of Phase Portraits, System Analysis on the Phase Plane.■

Module-5

Non-linear systems Analysis (continued): Simple Variable Structure Systems, Lyapunov Stability Definitions, Lyapunov Stability Theorems, Lyapunov Functions for Nonlinear Systems.■

Course Outcomes: At the end of the course the student will be able to:

- Discuss state variable approach for linear time invariant systems in both the continuous and discrete time systems.
- Develop of state models for linear continuous–time and discrete–time systems.
- Apply vector and matrix algebra to find the solution of state equations for linear continuous–time and discrete–time systems.
- Define controllability and observability of a system and test for controllability and observability of a given system.
- Design pole assignment and state observer using state feedback.
- Develop the describing function for the nonlinearity present to assess the stability of the system.
- Develop Lyapunov function for the stability analysis of nonlinear systems.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook

1	Control Systems Engineering (For the Modules1 and 2)	I.J. Nagarathand M.Gopal	NewAge	5^{th}Edition,2007
2	Digital Control and State Variable Methods: Conventional and Intelligent Control Systems	M.Gopal	McGrawHill	3^{rd}Edition,2008
3	Modern Control Theory	R. V. Parvatikar	Prism Books Pvt. Ltd.	1 Edition,2014

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER – VII			
REACTIVE POWER CONTROL IN ELECTRIC POWER SYSTEMS (Professional Elective)			
Subject Code	**18EE735**	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To identify the necessity of reactive power compensation.
- To describe load compensation.
- To select various types of reactive power compensation in transmission systems.
- To characterize distribution side and utility side reactive power management.
- To contrast reactive power coordination system.

Module-1

Theory of Load Compensation: Requirement for compensation, Objectives in load compensation, Ideal compensator, Acceptance standards for quality of supply, Specifications of a load compensator, Power factor correction and voltage regulations in single phase system: Power Factor and its Correction, Voltage regulation. T1. Classical load balancing problem: open loop balancing. R1.

Module-2

Theory of Steady State Reactive Power in Uncompensated & Compensated Transmission Line : Fundamental requirement in AC power transmission, advantages& disadvantages of different types of compensating equipment for transmission systems, fundamental transmission line equation, surge impedance and natural loading, voltage and current profiles of uncompensated line on open circuit, uncompensated line under load, effect of line length, load power and power factor on voltage and reactive power.

Compensated Transmission Line: Types of compensation, passive and active compensators,
Uniformly distributed fixed compensation: Effect of distributed compensation on voltage control and effect of distributed compensation on line charging reactive power. T1

Module-3

Basics of Capacitors, Reactive Power of Capacitors, Arrangements and Reactive Power of Capacitors, Capacitors Connected in Parallel: Capacitors Connected in Series, Star and Delta Connection of Power Capacitors, Design of MV Capacitors . T2

Passive shunt compensation: Control of open circuit voltage with shunt reactors, required reactance values of shunt reactors**.** T1

Series compensation: Objectives and practical limitations, Symmetrical line with mid-point series capacitor and shunt reactor, Power transfer characteristics and maximum transmissible power Fundamental concepts of compensation by sectioning. T1

Module-4

Static Compensation: Practical applications of static compensators in electrical power systems, main types of compensators, principle of operation of Thyristor Controlled Reactor (TCR), Thyristor Controlled Transformer, TCR with shunt capacitors and Thyristor Switched Capacitor (TSC), principle of operation of saturated reactor compensators.

Series Capacitors: compensation factor, protective gear, Varistor protective gear, Resonance effects with series capacitors

Synchronous Condenser: Condenser operation, Power system Voltage control, Emergency reactive power supply, HVDC application.

Comparison of basic types of compensator. T1

Module-5

Harmonics: Effect of harmonics on electrical equipment, resonance, shunt capacitors and filters, telephone interferences.
Reactive Power Co-ordination: Reactive power management, transmission benefits, reactive power dispatch & equipment impact.T1
Reactive Power Planning: Economic justification for reactive power planning, methods followed by the electricity boards in India, zonal reactive power requirements EHV & MV, low tension capacitors, placement in distribution, line capacitors. T3

Course Outcomes: At the end of the course the student will be able to:

- Distinguish the importance of load compensation in symmetrical as well as unsymmetrical loads.
- Observe various compensation methods in transmission lines.
- Distinguish demand side reactive power management & user side reactive power management.
- Construct model for reactive power coordination and effects of harmonics on electrical equipments.
- Discuss the Reactive Power Planning for the electricity boards.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Books

1	Reactive power control in electric power systems	T. J. E. Miller	John Wiley & Sons NY	2009
2	Reactive Power Compensation : A Practical Guide	Wolfgang Hofmann, Jurgen Schlabbach, Wolfgang Just.	John Wiley	2012
3	Reactive Power Management	D. Tagare	TMH	1st Edition,2004

Reference Books

1	Power Quality Enhancement Using Custom Power Devices	Arindam Ghosh, Gerard Ledwich	Kluwer International Series	2002
2	Power System Voltage Stability	Carson. W. Taylor,	McGraw-Hill, Inc.	1993

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII

INDUSTRIAL DRIVES AND APPLICATIONS (Professional Elective)

Course Code	**18EE741**	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To define electric drive, its parts, advantages and explain choice of electric drive.
- To explain dynamics and modes of operation of electric drives.
- To explain selection of motor power ratings and control of DC motor using rectifiers.
- To analyze the performance of induction motor drives under different conditions.
- To explain the control of induction motor, synchronous motor and stepper motor drives.
- To discuss typical applications electrical drives in the industry. ■

Module-1

Electrical Drives: Electrical Drives, Advantages of Electrical Drives. Parts of Electrical Drives, Choice of Electrical Drives, Status of DC and ac Drives.
Dynamics of Electrical Drives: Fundamental Torque Equations, Speed Torque Conventions and Multiquadrant Operation. Equivalent Values of Drive Parameters, Components of Load Torques, Nature and Classification of Load Torques, Calculation of Time and Energy Loss in Transient Operations, Steady State Stability, Load Equalization.
Control Electrical Drives: Modes of Operation, Speed Control and Drive Classifications, Closed loop Control of Drives. ■

Module-2

Direct Current Motor Drives: Controlled Rectifier Fed DC Drives, Single Phase Fully Controlled Rectifier Control of DC Separately Excited Motor, Single Phase Half Controlled Rectifier Control of DC Separately Excited Motor, Three Phase Fully Controlled Rectifier Control of DC Separately Excited Motor, Three Phase Half Controlled Rectifier Control of DC Separately Excited Motor, Multiquadrant Operation of DC Separately Excited Motor Fed Form Fully Controlled Rectifier, Rectifier Control of DC Series Motor, Supply Harmonics, Power Factor and Ripple in Motor Current, Chopper Control of Separately Excited DC Motor, Chopper Control of Series Motor. ■

Module-3

Induction Motor Drives: Analysis and Performance of Three Phase Induction Motors, Operation with Unbalanced Source Voltage and Single Phasing, Operation with Unbalanced Rotor Impedances, Analysis of Induction Motor Fed From Non-Sinusoidal Voltage Supply, Starting, Braking, Transient Analysis. Speed Control Techniques**-**Stator Voltage Control, Variable Voltage Frequency Control from Voltage Sources. ■

Module-4

Induction Motor Drives (continued): Voltage Source Inverter (VSI) Control, Cycloconverter Control, Closed Loop Speed Control and Converter Rating for VSI and Cycloconverter Induction Motor Drives, Variable Frequency Control from a Current Source, Current Source (CSI) Control, current regulated voltage source inverter control, speed control of single phase induction motors.

Synchronous Motor Drives: Operation from fixed frequency supply-starting, synchronous motor variable speed drives, variable frequency control of multiple synchronous motors. ■

Module-5

Synchronous Motor Drives (continued): Self-controlled synchronous motor drive employing load commutated thyristor inverter, Starting Large Synchronous Machines, Permanent Magnet ac (PMAC) Motor Drives, Sinusoidal PMAC Motor Drives, Brushless DC Motor Drives.
Stepper Motor Drives: Variable Reluctance, Permanent Magnet, Important Features of Stepper Motors, Torque Versus Stepping rate Characteristics, Drive Circuits for Stepper Motor.
Industrial Drives: Textile Mills, Steel Rolling Mills, Cranes and Hoists, Machine Tools. ■

Course Outcomes: At the end of the course the student will be able to:

- Explain the advantages, choice and control of electric drive
- Explain the dynamics, generating and motoring modes of operation of electric drives
- Explain the selection of motor power rating to suit industry requirements
- Analyze the performance & control of DC motor drives using controlled rectifiers
- Analyze the performance & control of converter fed Induction motor, synchronous motor & stepper motor drives.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Book

1	Fundamentals of Electrical Drives	Gopal K. Dubey	Narosa Publishing	2nd Edition, 2001
2	Electrical Drives: Concepts and Applications (Refer to chapter 07 for Industrial Drives	VedumSubrahmanyam	McGraw Hill	2nd Edition, 2011

Reference Books

1	Electric Drives	N.K De,P.K. Sen	PHI Learning	1st Edition, 2009

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
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SEMESTER – VII

UTILIZATION OF ELECTRICAL POWER(Professional Elective)

Course Code	**18EE742**	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To discuss electric heating, air-conditioning and electric welding.
- To explain laws of electrolysis, extraction and refining of metals and electro deposition.
- To explain the terminology of illumination, laws of illumination, construction and working of electric lamps.
- To explain design of interior and exterior lighting systems- illumination levels for various purposes light fittings- factory lighting- flood lighting-street lighting
- To discuss systems of electric traction, speed time curves and mechanics of train movement.
- To discuss motors used for electric traction and their control.
- To discuss braking of electric motors, traction systems and power supply and other traction systems.
- Give awareness of technology of electric and hybrid electric vehicles. ■

Module-1

Heating and welding: Electric Heating, Resistance ovens, Radiant Heating, Induction Heating, High frequency Eddy Current Heating, Dielectric Heating, The Arc Furnace, Heating of Buildings, Air – Conditioning, Electric Welding, Modern Welding Techniques.

Electrolytic Electro – Metallurgical Process: Ionization, Faraday's Laws of Electrolysis, Definitions, Extraction of Metals, Refining of Metals, Electro Deposition. ■

Module-2

Illumination: Introduction, Radiant Energy, Definitions, Laws of Illumination, Polar Curves, Photometry, Measurement of Mean Spherical Candle Power by Integrating Sphere, Illumination Photometer, Energy Radiation and luminous Efficiency, electric Lamps, Cold Cathode Lamp, Lighting Fittings, Illumination for Different Purposes, Requirements of Good Lighting. ■

Module-3

Electric Traction Speed - Time Curves and Mechanics of Train Movement: Introduction, Systems of Traction, Systems of electric Traction, Speed - Time Curves for Train Movement,Mechanics of Train Movement, Train Resistance, Adhesive Weight, Coefficient of Adhesion.

Motors for Electric traction: Introduction, Series and Shunt Motors for Traction Services, Two Similar Motors (Series Type) are used to drive a Motor Car, Tractive Effort and Horse Power, AC Series Motor, Three Phase Induction Motor.

Control of motors: Control of DC Motors,Tapped Field Control or Control by Field Weakening, Multiple Unit Control, Control of Single Phase Motors, Control of Three Phase Motors. ■

Module-4

Braking: Introduction, Regenerative Braking with Three Phase Induction Motors, Braking with Single Phase Series Motors, Mechanical braking, Magnetic Track Brake, Electro – Mechanical Drum Brakes.

Electric Traction Systems and Power Supply: System of Electric Traction, AC Electrification Transmission Lines to Sub - Stations, Sub – Stations, Feeding and Distribution System of AC Traction Feeding and Distribution System for DC Tramways, Electrolysis by Currents through Earth, Negative Booster, System of Current Collection, Trolley Wires.

Trams, Trolley Buses and Diesel – Electric Traction: Tramways, The Trolley – Bus, Diesel Electric Traction. ■

Module-5

Electric Vehicles: Configurations of Electric Vehicles, Performance of Electric Vehicles, Tractive Effort in Normal Driving, Energy Consumption.

Hybrid Electric Vehicles: Concept of Hybrid Electric Drive Trains, Architectures of Hybrid Electric Drive Trains. ■

Course Outcomes: At the end of the course the student will be able to:

- Discuss different methods of electric heating & welding.
- Discuss the laws of electrolysis, extraction, refining of metals and electro deposition process.
- Discuss the laws of illumination, different types of lamps, lighting schemes and design of lighting systems.
- Analyze systems of electric traction, speed time curves and mechanics of train movement.
- Explain the motors used for electric traction, their control & braking and power supply system used for electric traction.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Book

1	A Text Book on Power System Engineering	A. Chakrabarti et al	DhanpatRai and Co	2nd Edition, 2010
2	Modern Electric,Hybrid Electric, and Fuel Cell Vehicles: Fundamentals Theory, and Design (Chapters 04 and 05 for module 5)	Mehrdad Ehsani et al	CRC Press	1stEdition, 2005

Reference Books

1	Utilization, Generation and Conservation of Electrical Energy	Sunil S Rao	Khanna Publishers	1stEdition, 2011
2	Utilization of Electric Power and Electric Traction	G.C. Garg	Khanna Publishers	9thEdition, 2014

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII

PLC and SCADA(Professional Elective)

Course Code	**18EE743**	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3L	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To explain advantages and disadvantages, main parts and their functions, basic sequence of operation of PLC.
- To describe the hardware components: I/O modules, CPU, memory devices, other support devices and the functions of PLC memory map.
- To describe program scan sequence, the communication of information to the PLC using different languages, internal relay instruction.
- To explain identification of common operating modes found in PLCs, writing and entering the ladder logic programs.
- To define the functions of Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-in Circuits and Latching Relays.
- To discuss the operation of various processes, structures of control systems and the method of communication between different industrial processes.
- To understand SCADA and how it deals with the control and data acquisition from systems
- To understand what RTU does, how it does and what. ■

Module-1

Programmable Logic Controllers: Introduction, Parts of a PLC, Principles of Operation, Modifying the Operation, PLCs versus Computers, PLC Size and Application.

PLC Hardware Components: The I/O Section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O Specifications, The Central Processing Unit (CPU), Memory Design, Memory Types, Programming Terminal Devices, Recording and Retrieving Data, Human Machine Interfaces (HMIs).

Basics of PLC Programming: Processor Memory Organization, Program Scan, PLC Programming Languages, Relay-Type Instructions, Instruction Addressing, Branch Instructions, Internal Relay Instructions, Programming Examine If Closed and Examine If Open Instructions, Entering the Ladder Diagram, Modes of operation■

Module-2

Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs: Electromagnetic Control Relays, Contactors, Motor Starters, Manually Operated Switches, Mechanically Operated Switches, Sensors, Output Control Devices, Seal-in Circuits, Latching Relays, Converting Relay Schematics into PLC Ladder Programs, Writing a Ladder Logic Program Directly from a Narrative Description.

Programming Timers: Mechanical Timing Relays, Timer Instructions, On-Delay Timer Instruction, Off-Delay Timer Instruction, Retentive Timer, Cascading Timers.■

Module-3

Programming Counters: Counter Instructions, Up-Counter, Down-Counter, Cascading Counters, Incremental Encoder-Counter Applications, Combining Counter and Timer Functions.

Program Control Instructions: Master Control Reset Instruction, Jump Instruction, Subroutine Functions, Immediate Input and Immediate Output Instructions, Forcing External I/O Addresses, Safety Circuitry, Selectable Timed Interrupt, Fault Routine, Temporary End Instruction, Suspend Instruction. ■

Module-4

SCADA Fundamentals: Introduction, Open system: Need and advantages, Building blocks of SCADA systems, Remote terminal unit (RTU): Evolution of RTUs, Components of RTU, Communication subsystem, Logic subsystem, Termination subsystem, Testing and human-machine interface (HMI) subsystem, Power supplies, Advanced RTU functionalities, Intelligent electronic devices (IEDs), Data concentrators and merging units, SCADA communication systems,

Master Station: Master station software components, Master station hardware components, Server systems in the master station, Small, medium, and large master stations, Global positioning systems (GPS), Master station performance. ■

Module-5

Human-Machine Interface (HMI):HMI components, HMI software functionalities, Situational awareness, Intelligent alarm filtering: Need and technique, Alarm suppression techniques, Operator needs and requirements,

SCADA Systems: Building the SCADA systems, legacy, hybrid, and new systems, Classification of SCADA systems, SCADA implementation: A laboratory model: The SCADA laboratory, System hardware, System software, SCADA lab field design. ■

Course Outcomes: At the end of the course the student will be able to:

- Discuss history of PLC, its sequence of operation, advantages and disadvantages, main parts and their functions.
- Describe the hardware components of PLC: I/O modules, CPU, memory devices, other support devices, operating modes and PLC programming.
- Describe field devices Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits, and Latching Relays commonly used with I/O module.
- Convert relay schematics and narrative descriptions into PLC ladder logic programs.
- Analyse PLC timer and counter ladder logic programs.
- Understand about SCADA systems and its subsystems. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	Programmable Logic Controllers	Frank D Petruzella	McGraw Hill	4th Edition, 2011
2	Power System SCADA and Smart Grids	Mini S. Thomas	CRC Press	3rd Edition,2015

Reference Book

1	Programmable Logic Controllers an Engineer's Guide	E A Parr	Newnes	3rd Edition, 2013
2	Introduction Programmable Logic Controllers	Gary Dunning	Cengage	3rd Edition, 2006

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SEMESTER – VII

SMART GRID (Professional Elective)

Course Code	**18EE744**	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3L	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To understand the basic concept of smart grid, attributes of Smart Grid
- To describe the over view of the perfect power system configuration
- To know about DC power delivering systems ,data centers and information technology loads
- To educate the importance of Technology Alternatives in smart Grid
- To understand the Dynamic energy systems in Smart Grid
- To describe the overview of Demand side planning and evaluation

Module-1

Introduction: Introduction to smart grid, electricity network, local energy networks, electric transportation, low carbon central generation, attributes of the smart grid.

Smart Grid to Evolve a Perfect Power System: Introduction, overview of the perfect power system configurations, device level power system, building integrated power systems, distributed power systems, fully integrated power system.■

Module-2

DC Distribution and Smart Grid: AC Vs. DC sources, benefits of and drives of DC power delivery systems, powering equipment and appliances with DC, data centers and information technology loads, potential future work and research

Intelligrid Architecture for the Smart Grid: Introduction, launching intelligrid, intelligrid today, smart grid vision based on the intelligrid architecture.■

Module-3

Dynamic Energy Systems Concept: Smart energy efficient end use devices, smart distributed energy resources, advanced whole building control systems, integrated communications architecture, energy management, role of technology in demand response, current limitations to dynamic energy management, distributed energy resources, overview of a dynamic energy management, key characteristics of smart devices, key characteristics of advanced whole building control systems, key characteristics of dynamic energy management system.■

Module-4

Efficient Electric End Use Technology Alternatives: Existing technologies ,lighting, space conditioning, indoor air quality, domestic water heating, hyper efficient appliances, ductless residential heat pumps and air conditioners, variable refrigerant flow air conditioning, heat pump water heating, hyper efficient residential appliances, data center energy efficiency, LED street and area lighting, industrial motors and drives, equipment retrofit and replacement, process heating, cogeneration, thermal energy storage, industrial energy management programs, manufacturing process, electro -technologies, residential, commercial and industrial sectors.■

Module-5

Demand side planning: Introduction, Selecting Alternatives, Issues Critical to the Demand-side Issues Critical to the Demand-side, The Utility Planning Process, Demand-side Activities, Alternatives that Are Most Beneficial.

Demand-Side Evaluation: Levels of Analysis. General Information Requirements .System, Context, Transferability, Data Requirement, Cost/Benefit Analysis, Program Interaction.■

Course Outcomes: At the end of the course the student will be able to:

- Explain the concept of Smart grid enables the ElectricNet and need of smart grid.
- Outline the benefits and drivers of DC Power delivery system.
- Summarize the Intelligrid Architecture for the smart grid.
- Explain the Efficient Electric End-use Technology Alternatives.
- Discuss Demand side planning and Evaluation.■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.

Students will have to answer 5 full questions, selecting one full question from each module.■

Textbook

1	The Smart Grid, Enabling Energy Efficiency and Demand Side Response	Clark W Gellings	CRC Press, 2009.	3rd Edition, 2013.

Reference Books

1	Smart Grid :Technology and Applications	Janaka Ekanayake, Kithsiri Liyanage,Jianzhong	Wiley	2012
2	Fundamentals of Design and Analysis	James Momoh	Wiley, IEEE Press,	2012

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SEMESTER – VII

ARTIFICIAL NEURAL NETWORK WITH APPLICATIONS TO POWER SYSTEMS
(Professional Elective)

Subject Code	**18EE745**	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	4	Exam Hours	03

Course Learning Objectives:

- To understand the fundamental concepts and models of Artificial Neural Systems.
- To understand neural processing, learning and adaptation, Neural Network learning rules.
- Ability to analyze multilayer feed forward networks.
- Ability to develop various ancillary techniques applied to power system and control of power systems.

Module-1

Fundamental Concepts and Models of Artificial Neural Systems

Biological Neurons and their artificial models – Biological Neuron, McCulloch-Pitts Neuron Model, Neuron modeling for Artificial neural systems. Models for Artificial Neural Networks – Feedforward Network, Feedback network. ■

Module-2

Neural Processing, Learning and Adaptation, Neural Network Learning Rules

Neural Processing. Learning and Adaptation – Learning as Approximation or Equilibria Encoding, Supervised and Unsupervised Learning. Neural Network Learning Rules – Hebbian Learning Rule, Perceptron Learning Rule, Delta Learning Rule, Widrow-Hoff Learning Rule, Correlation Learning Rule, Winner-Take-All Learning Rule, Outstar Learning Rule, Summary of Learning Rules. ■

Module-3

Multilayer Feedforward Networks

Feedforward Recall and Error Back-Propagation Training – Feedforward Recall, Error Back-Propagation Training, Training Errors and Multilayer Feedforward Networks as Universal Approximators (Excluding Examples). Learning Factors – Initial Weights, Cumulative Weight Adjustment versus Incremental Updating, Steepness of the Activation Function, Learning Constant, Momentum Method, Network Architectures Versus Data Representation, Necessary Number of Hidden Neurons. ■

Module-4

Neural Network and its Ancillary Techniques as Applied to Power Systems

Introduction, Learning versus Memorization, Determining the Best Net Size, Network Saturation, Feature Extraction, Inversion of Neural Networks, Alternative Training Method: Genetic Based Neural Network, Fuzzified Neural Network. ■

Module – 5

Control of Power Systems

Introduction, Background, Neural Network Architectures for modeling and control, Supervised Neural Network Structures, Diagonal Recurrent Neural Network based Control System, Convergence and Stability. ■

Course Outcomes: At the end of the course the student will be able to:

- Develop Neural Network and apply elementary information processing tasks that neural network can solve.
- Develop Neural Network and apply powerful, useful learning techniques.
- Develop and Analyze multilayer feed forward network for mapping provided through the first network layer and error back propagation algorithm.
- Analyze and apply algorithmic type problems to tackle problems for which algorithms are not available.
- Develop and Analyze supervised/unsupervised, learning modes of Neural Network for different applications. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books

1	Introduction to Artificial Neural Systems.	Jacek M. Zurada	JAICO Publishing House	2006
2	Artificial Neural Networks with Applications to Power Systems	Edited by – Mohamed El – Sharkawi and Dagmar Niebur	IEEE, Inc.	1996

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER – VII			
POWER SYSTEM SIMULATION LABORATORY			
Course Code	**18EEL76**	CIE Marks	40
Number of Practical Hours/Week(L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

To explain the use of standard software package:
(Ex: MATLAB/C or C ++/Scilab/ Octave/Python software)

- To assess the performance of medium and long transmission lines.
- To obtain the power angle characteristics of salient and non- salient pole alternator.
- To study transient stability of radial power systems under three phase fault conditions.
- To develop admittance and impedance matrices of interconnected power systems.
- To explain the use of suitable standard software package.
- To solve power flow problem for simple power systems.
- To perform fault studies for simple radial power systems.
- To study optimal generation scheduling problems for thermal power plants.

Sl. No.		Experiments
1	Use of Standard Simulation Software Package	Formation for symmetric π /T configuration for Verification of Determination of Efficiency and Regulation.
2		Determination of Power Angle Diagrams, Reluctance Power, Excitation, EMF and Regulation for Salient and Non-Salient Pole Synchronous Machines.
3		To obtain Swing Curve and to Determine Critical Clearing Time, Regulation, Inertia Constant/Line Parameters /Fault Location/Clearing Time/Pre-Fault Electrical Output for a Single Machine connected to Infinite Bus through a Pair of identical Transmission Lines Under 3-Phase Fault On One of the two Lines.
4		Y Bus Formation for Power Systems with and without Mutual Coupling, by Singular
5		Formation of Z Bus(without mutual coupling) using Z-Bus Building Algorithm.
6		Determination of Bus Currents, Bus Power and Line Flow for a Specified System Voltage
7		Formation of Jacobian for a System not Exceeding 4 Buses in Polar Coordinates.
8		Load Flow Analysis using Gauss Siedel Method, NR Method and Fast Decoupled Method for Both PQ and PV Buses.
9		To Determine Fault Currents and Voltages in a Single Transmission Line System with
10		Optimal Generation Scheduling for Thermal power plants by simulation.

Course Outcomes: At the end of the course the student will be able to:

- Develop a program in suitable package to assess the performance of medium and long transmission lines.
- Develop a program in suitable package to obtain the power angle characteristics of salient and non-salient pole alternator.
- Develop a program in suitable package to assess the transient stability under three phase fault at different locations in a of radial power systems.
- Develop programs in suitable package to formulate bus admittance and bus impedance matrices of interconnected power systems.
- Use suitable package to solve power flow problem for simple power systems.
- Use suitable package to study unsymmetrical faults at different locations in radial power systems
- Use of suitable package to study optimal generation scheduling problems for thermal power plants.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER – VII			
RELAY AND HIGH VOLTAGE LABORATORY			
Course Code	**18EEL77**	CIE Marks	40
Number of Practical Hours/Week	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To conduct experiments to verify the characteristics of over current, over voltage, under voltage relays both electromagnetic and static type.
- To verify the operation of negative sequence relay.
- To conduct experiments to verify the characteristics of microprocessor based over current, over voltage, under voltage relays and distance relay.
- To conduct experiments on generator, motor and feeder protection.
- To conduct experiments to study the spark over characteristics for both uniform and non-uniform configurations using High AC and DC voltages.
- To measure high AC and DC voltages
- To experimentally measure the breakdown strength of transformer oil.
- To experimentally measure the capacitance of different electrode configuration models using
- Electrolytic Tank. To generate standard lightning impulse voltage and determine efficiency, energy of impulse generator and 50% probability flashover voltage for air insulation. ■

Sl. NO		Experiments
Total of Six experiments are to be conducted by selecting Two experiments from each Part – A, Part – B and Part – C. Five out of six experiments are to be conducted under Part – D.		
1	**Part - A**	Over Current Relay: (a)Inverse Definite Minimum Time(IDMT)Non-Directional Characteristics (b) Directional Features (c) IDMT Directional.
2		IDMT Characteristics of Over Voltage or Under Voltage Relay (Solid State or Electromechanical type).
3		Operation of Negative Sequence Relay.
4	**Part - B**	Operating Characteristics of Microprocessor Based (Numeric) Over –Current Relay.
5		Operating Characteristics of Microprocessor Based (Numeric) Distance Relay.
6		Operating Characteristics of Microprocessor Based (Numeric) Over/Under Voltage
7	**Part - C**	Generation Protection: Merz Price Scheme.
8		Feeder Protection against Faults.
9		Motor Protection against Faults.
10	**Part - D**	Spark Over Characteristics of Air subjected to High Voltage AC with Spark Voltage Corrected to Standard Temperature and Pressure for Uniform [as per IS1876: 2005]and Non-uniform [as per IS2071(Part 1) : 1993] Configurations: Sphere – Sphere, Point –Plane,
11		Spark Over Characteristics of Air subjected to High voltage DC.
12		Measurement of HVAC and HVDC using Standard Spheres as per IS 1876 :2005
13		Measurement of Breakdown Strength of Transformer Oil as per IS 1876 :2005
14		Field Mapping using Electrolytic Tank for any one of the following Models: Cable/ Capacitor/
15		(a) Generation of standard lightning impulse voltage and to determine efficiency and energy of impulse generator. (b) To determine 50% probability flashover voltage for air insulation subjected to impulse voltage.

Course Outcomes: At the end of the course the student will be able to:

- Verify the characteristics of over current, over voltage, under voltage and negative sequence relay both electromagnetic and static type.
- Verify the characteristics of microprocessor based over current, over voltage, under voltage relays and distance relay.
- Show knowledge of protecting generator, motor and feeders.
- Analyze the spark over characteristics for both uniform and non-uniform configurations using High A and DC voltages.
- Measure high AC and DC voltages and breakdown strength of transformer oil.
- Draw electric field and measure the capacitance of different electrode configuration models.
- Show knowledge of generating standard lightning impulse voltage to determine efficiency, energy of impulse generator and 50% probability flashover voltage for air insulation.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII

PROJECT PHASE – I

Course Code	**18EEP78**	CIE Marks	100
Number of Practical Hours/Week	0:0:2	Exam Hours	--
Credits	1	Exam Marks	--

Course Learning Objectives:

- Support independent learning.
- Guide to select and utilize adequate information from varied resources maintaining ethics.
- Guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- Develop interactive, communication, organization, time management, and presentation skills.
- Impart flexibility and adaptability.
- Inspire independent and team working.
- Expand intellectual capacity, credibility, judgment, intuition.
- Adhere to punctuality, setting and meeting deadlines.
- Instil responsibilities to oneself and others.
- Train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas. ∎

Project Phase-1 Students in consultation with the guide/s shall carry out literature survey/ visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare synopsis and narrate the methodology to carry out the project work

Course Outcomes: At the end of the course the student will be able to:

- Demonstrate a sound technical knowledge of their selected project topic.
- Undertake problem identification, formulation and solution.
- Design engineering solutions to complex problems utilizing a systems approach.
- Communicate with engineers and the community at large in written an oral forms.

Continuous Internal Evaluation

CIE marks for the project phase I 100 marks.

i. Report 50 marks
ii. Partial result and presentation 50 marks

Marks shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairman.

VIII SEMESTER DETAILED SYLLABUS

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VIII

POWER SYSTEM OPERATION AND CONTROL(Core Course)

Course Code	**18EE81**	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To describe various levels of controls in power systems and the vulnerability of the system.
- To explain components, architecture and configuration of SCADA.
- To explain basic generator control loops, functions of Automatic generation control, speed governors and mathematical models of Automatic Load Frequency Control
- To explain automatic generation control, voltage and reactive power control in an interconnected power system.
- To explain reliability and contingency analysis, state estimation and related issues. ■

Module-1

Introduction: Operating States of Power System, Objectives of Control, Key Concepts of Reliable Operation, Preventive and Emergency Controls, Energy Management Centers. R1

Supervisory Control and Data acquisition (SCADA): Introduction, components, application in Power System, basic functions and advantages. Building blocks of SCADA system, components of RTU, communication subsystem, IED functional block diagram. R2

Classification of SCADA system: Single master–single remote; Single master–multiple RTU; Multiple master–multiple RTUs; and Single master, multiple submaster, multiple remote. ■ R2

Module-2

Automatic Generation Control (AGC): Introduction, Schematic diagram of load frequency and excitation voltage regulators of turbo generators, Load frequency control (Single area case), Turbine speed governing system, Model of speed governing system, Turbine model, Generator load model, Complete block diagram of representation of load frequency control of an isolated power system, Steady state analysis, Control area concept, Proportional plus Integral Controller. ■ T1

Module-3

Automatic Generation Control in Interconnected Power system: Two area load frequency control, Optimal (Two area) load frequency control by state variable, Automatic voltage control, Load frequency control with generation rate constraints (GRCs), Speed governor dead band and its effect on AGC, Digital LF Controllers, Decentralized control. ■ T1

Module-4

Control of Voltage and Reactive Power: Introduction, Generation and absorption of reactive power, Relation between voltage, power and reactive power at a node, Methods of voltage control: i. Injection of reactive power, Shunt capacitors and reactors, Series capacitors, Synchronous compensators, Series injection. ii Tap changing transformers. Combined use of tap changing transformers and reactive power injection, Booster transformers, Phase shift transformers, Voltage collapse. ■ T3

Module-5

Power System Security: Introduction, Factors affecting power system security, Contingency Analysis, Linear Sensitivity Factors, AC power flow methods, Contingency Selection and Ranking. T2

State estimation of Power Systems: Introduction, Linear Least Square Estimation. T2

Course Outcomes: At the end of the course the student will be able to:

- Describe various levels of controls in power systems, architecture and configuration of SCADA.
- Develop and analyze mathematical models of Automatic Load Frequency Control.
- Develop mathematical model of Automatic Generation Control in Interconnected Power system
- Discuss the Control of Voltage , Reactive Power and Voltage collapse.
- Explain security, contingency analysis, state estimation of power systems.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Book

1	Modern Power System Analysis	D. P. Kothari	McGraw Hill	4th Edition, 2011
2	Power Generation Operation and Control	Allen J Wood etal	Wiley	2nd Edition,2003
3	Electric Power Systems	B M Weedy, B J	Wiley	4th Edition, 2012

Reference Books

1	Computer-Aided Power System Analysis	G. L. Kusic	CRC Press	2nd Edition.2010
2	Power System SCADA and Smart Grid	Mini S Thom and John D. McDonald	CRC Press	2015
3	Power System Stability and Control	Kundur	McGraw Hill	8th Reprint, 2009

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER – VIII			
FACTS AND HVDC TRANSMISSION (Professional Elective)			
Course Code	**18EE821**	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	3	Exam Hours	03

Course Learning Objectives:

- To discuss transmission interconnections, flow of Power in an AC System, limits of the loading capability, dynamic stability considerations of a transmission interconnection and controllable parameters.
- To explain the basic concepts, definitions of flexible ac transmission systems and benefits from FACTS technology.
- To describe shunt controllers, Static Var Compensator and Static Compensator for injecting reactive power in the transmission system in enhancing the controllability and power transfer capability.
- To describe series Controllers Thyristor-Controlled Series Capacitor (TCSC) and the Static Synchronous Series Compensator (SSSC) for control of the transmission line current.
- To explain advantages of HVDC power transmission, overview and organization of HVDC system.
- To describe the basic components of a converter, the methods for compensating the reactive power demanded by the converter.
- Explain converter control for HVDC systems, commutation failure, control functions.■

Module-1

FACTS Concept and General System Considerations: Transmission Interconnections, Flow of Power in an AC System, What Limits the Loading Capability? Power Flow and Dynamic Stability Considerations of a Transmission Interconnection, Relative Importance of Controllable Parameters, Basic Types of FACTS Controllers, Brief Description and Definitions of FACTS Controllers, Checklist of Possible Benefits from FACTS Technology, In Perspective: HVDC or FACTS.■

Module-2

Static Shunt Compensators: Objectives of Shunt Compensation - Midpoint Voltage Regulation for Line Segmentation, End of Line Voltage Support to Prevent Voltage Instability, Improvement of Transient Stability. Methods of Controllable Var Generation –Thyristor controlled Reactor (TCR) and Thyristor Switched Reactor (TSR), Thyristor Switched Capacitor (TSC).Operation of Single Phase TSC – TSR. Switching Converter Type Var Generators, Basic Operating Principles, Basic Control Approaches. Static VAR Compensators: SVC and STATCOM, the Regulation Slope. Comparison between STATCOM and SVC, V –I and V –Q Characteristics, Transient stability, Response Time.■

Module-3

Static Series Compensators: Objectives of Series Compensation, Concept of Series Capacitive Compensation, Voltage Stability, Improvement of Transient Stability. GTO Thyristor-Controlled Series Capacitor, Thyristor-Switched Series Capacitor, Thyristor-Controlled Series Capacitor, The Static synchronous Series Compensator, Transmitted Power Versus Transmission AngleCharacteristic.■

Module-4

Development of HVDC Technology: Introduction, Advantages of HVDC Systems, HVDC System Costs, Overview and Organization of HVDC Systems, HVDC Characteristics and Economic Aspects.

Power Conversion:3-Phase Converter, 3-Phase Full Bridge Converter, 12-Pulse Converter.■

Module-5				
Control of HVDC Converter and System: Converter Control for an HVDC System, Commutation Failure, HVDC Control and Design, HVDC Control Functions, Reactive Power and Voltage Stability.				
Course Outcomes: At the end of the course the student will be able to: • Discuss transmission interconnections, flow of Power in an AC System, limits of the loading capability, dynamic stability considerations of a transmission interconnection and controllable parameters. • Explain the basic concepts, definitions of flexible ac transmission systems and benefits from FACTS technology. • Describe shunt controllers, Static Var Compensator and Static Compensator for injecting reactive power in the transmission system in enhancing the controllability and power transfer capability. • Describe series Controllers Thyristor-Controlled Series Capacitor (TCSC) and the Static Synchronous Series Compensator (SSSC) for control of the transmission line current. • Explain advantages of HVDC power transmission, overview and organization of HVDC system. • Describe the basic components of a converter, the methods for compensating the reactive power demanded by the converter. • Explain converter control for HVDC systems, commutation failure, control				
Question paper pattern: • The question paper will have ten questions. • Each full question is for 20 marks. • There will be 2 full questions (with a maximum of three sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module.				
Text Books				
1	Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems	Narain G Hingorani, Laszlo Gyugyi	Wiley	1st Edition, 2000
2	HVDC Transmission: Power Conversion Applicationsin Power Systems	Chan-Ki Kim et al	Wiley	1st Edition, 2009
Reference Books				
1	Thyristor Based FACTS Controllers for Electrical Transmission Systems	R. Mohan Mathur, Rajiv K. Varma	Wiley	1st Edition, 2002

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VIII

ELECTRICAL ESTMATION AND COSTING (Professional Elective)

Course Code	**18EE822**	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To discuss the purpose of estimation and costing.
- To discuss market survey, estimates, purchase enquiries, tenders, comparative statement and payment of bills and Indian electricity act and some of the rules.
- To discuss distribution of energy in a building, wiring and methods of wiring, cables used in internal wiring, wiring accessories, fittings and fuses.
- To discuss design of lighting points and its number, total load, sub-circuits, size of conductor.
- To discuss different types of service mains and estimation of power circuits.
- To discuss estimation of overhead transmission and distribution system and its components.
- To discuss main components of a substation, their graphical representation and preparation of single line diagram of a substation. ■

Module-1

Principles of Estimation: Introduction to Estimation and Costing, Electrical Schedule, Catalogues, Market Survey and Source Selection, Recording of Estimates, Determination of Required Quantity of Material, Labour Conditions, Determination of Cost Material and Labour, Contingencies, Overhead Charges, Profit, Purchase System, Purchase Enquiry and Selection of Appropriate Purchase Mode, Comparative Statement, Purchase Orders, Payment Of Bills, Tender Form, General Idea about IE Rule, Indian Electricity(IE) Act and IE Rules -29,30,45,46,47,50,51,54,55,77 and79. ■

Module-2

Wiring: Introduction, Distribution of energy in a Building, PVC Casing and Capping, Conduit Wiring, Desirabilities of Wiring. Types of cables used in Internal Wiring, Multi Strand Cables, Voltage Grading and Specification of Cables

Wiring (continued): Main Switch and Distribution Board, Conduits and its accessories and Fittings. Lighting Accessories and Fittings, Types of Fuses, Size of Fuse, Fuse Units, Earthing Conductor.

Internal Wiring: General rules for wiring, Design of Lighting Points (Refer to Seventh Chapter of the Text Book), Number of Points, Determination of Total Load, Number of Sub –Circuits, Ratings Main Switch and Distribution Board and Size of Conductor. Current Density, Layout. ■

Module-3

Service Mains: Introduction, Types, Estimation of Underground and Overhead Service Connections.

Design and Estimation of Power Circuits: Introduction, Important Considerations Regarding Motor Installation Wiring, Input Power, Input Current to Motors, Rating of Cables, Rating of Fuse, Size of Condit, Distribution Board Main Switch and Starter. ■

Module-4

Estimation of Overhead Transmission and Distribution Lines: (Review of Line Supports, Conductor Materials, Size of Conductor for Overhead Transmission Line, Types of Insulators)[No Question Shall be Set From the Review Portion].

Cross Arms, Pole Brackets and Clamps, Guys and Stays, Conductors Configuration Spacing and Clearances, Span Lengths, Lightning Arrestors, Phase Plates, Danger Plates, Anti Climbing Devices, Bird Guards, Beads of Jumpers, Muffs, Points to be Considered at the Time of Erection of Overhead Lines, Erection of Supports, Setting of Stays, Fixing of Cross Arms, Fixing of Insulators, Conductor Erection. ■

Module-4 (continued)

Estimation of Overhead Transmission and Distribution Lines (continued): Repairing and Jointing of Conductors, Dead End Clamps, Positioning of Conductors and Attachment to Insulator s, Jumpers, Tee-Offs, Earthing of Transmission Lines, Guarding of Overhead Lines, Clearances of Conductor From Ground, Spacing Between Conductors, Important Specifications. ■

Module-5

Estimation of Substations: Main Electrical connection, Graphical Symbols for Various Types of Apparatus and Circuit Elements on Substation main Connection Diagram, Single Line Diagram of Typical Substations, Equipment for Substation, Substation Auxiliaries Supply, Substation Earthing. ■

Course Outcomes: At the end of the course the student will be able to:

- Explain general principles of estimation and major applicable I.E. rules.
- Discuss wiring methods, cables used, design of lighting points and sub-circuits, internal wiring, wiring accessories and fittings, fuses and types.
- Discuss estimation of service mains and power circuits.
- Discuss estimation of overhead transmission and distribution system its components.
- Discuss types of substation, main components and estimation of substation.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Book

1	A Course in Electrical Installation Estimating and Costing	J. B. Gupta	Katson Books,	9th Edition, 2012

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VIII

ELECTRIC VEHICLE TECHNOLOGIES (Professional Elective)

Subject Code	**18EE823**	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To understand working of Electric Vehicles and recent trends.
- Ability to analyze different power converter topology used for electric vehicle application.
- Ability to develop the electric propulsion unit and its control for application of electric vehicles.
- Ability to design converters for battery charging and explain transformer less topology.

Module-1

Electric and Hybrid Electric Vehicles

Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains. ■

Module-2

Energy storage for EV and HEV

Energy storage requirements, Battery parameters, Types of Batteries, Modelling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, PEMFC and its operation, Modelling of PEMFC, Supercapacitors. ■

Module-3

Electric Propulsion

EV consideration, DC motor drives and speed control, Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration and control of Drives. ■

Module – 4

Design of Electric and Hybrid Electric Vehicles

Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components, power rating of traction motor, power rating of engine/generator, design of PPS Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train, design of engine power capacity, design of electric motor drive capacity, transmission design, energy storage design. ■

Module – 5

Power Electronic Converter for Battery Charging

Charging methods for battery, Termination methods, charging from grid, The Z-converter, Isolated bidirectional DC-DC converter, Design of Z- converter for battery charging, High-frequency transformer based isolated charger topology, Transformer less topology. ■

Course Outcomes: At the end of the course the student will be able to:

- Explain the working of electric vehicles and recent trends.
- Analyze different power converter topology used for electric vehicle application.
- Develop the electric propulsion unit and its control for application of electric vehicles.
- Design converters for battery charging and explain transformer less topology. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books

1	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design	M. Ehsani, Y. Gao, S. Gay and Ali Emadi	CRC Press	2005
2	Electric and Hybrid Vehicles: Design Fundamentals	Iqbal Husain	CRC Press	2003

Reference Books

1	Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles	Sheldon S. Williamson	Springer	2013
2	Modern Electric Vehicle Technology	C.C. Chan and K.T. Chau	OXFORD University	2001
3	Hybrid Electric Vehicles Principles And Applications With Practical Perspectives	Chris Mi, M. Abul Masrur, David Wenzhong Gao	Wiley Publication	2011

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) AND OUTCOME BASED EDUCATION (OBE)			
POWER SYSTEM PLANNING (Professional Elective)			
Subject Code	**18EE824**	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To discuss primary components of power system planning namely load furcating, evaluation of energy resources, provisions of electricity Act and Energy Conservation Act.
- To explain planning methodology for optimum power system expansion, various types of generation, transmission and distribution
- To explain forecasting of anticipated future load requirements of both demand and energy by deterministic and statistical techniques using forecasting tools.
- To discuss methods to mobilize resources to meet the investment requirement for the power sector
- To perform economic appraisal to allocate the resources efficiently and take proper investment decisions
- To discuss expansion of power generation and planning for system energy in the country
- To discuss evaluation of operating states of transmission system, their associated contingencies and determination of the stability of the system for worst case conditions
- To discuss principles of distribution planning, supply rules, network development and the system studies
- To discuss reliability criteria for generation, transmission, distribution and reliability evaluation and analysis.
- To discuss grid reliability, voltage disturbances and their remedies.
- To discuss planning and implementation of electric –utility activities designed to influence consumer uses of electricity.
- To discuss market principles and the norms framed by CERC for online trading and exchange in the interstate power market. ■

Module-1

Power System: Planning Principles, Planning Process, Project Planning, Power Development, National and Regional Planning, Enterprise Resources Planning, Planning Tools, Power Planning Organisation, Scenario Planning.
Electricity Forecasting: Load Requirement, System Load, Electricity Forecasting, Forecasting Techniques, Forecasting Modelling, Spatial – Load Forecasting, Peak Load - Forecast, Reactive – Load Forecast, Unloading of a System.■

Module-2

Power-System Economics: Financial Planning, Techno – Economic Viability, Private Participation, Financial Analysis, Economic Analysis, Transmission, Rural Electrification Investment, Total System Analysis, Credit - Risk Assessment.

Generation Expansion: Generation Capacity and Energy, Generation Mix, Clean Coal Technologies Renovation and Modernisation of Power Plants. ■

Module-3

Transmission Planning: Transmission Planning Criteria, Right – of – Way, Network Studies, High – Voltage Transmission, HVDC Transmission, Conductors, Sub – Stations, Power Grid, Reactive Power Planning, Energy Storage.■

Module-4

Distribution: Distribution Deregulation, Planning Principles, Electricity – Supply Rules, Criteria and Standards, Sub – Transmission, Basic Network, Low Voltage Direct Current Electricity,

Module-4 (continued)

Distribution(continued): Upgradation of Existing Lines and Sub – Stations, Network Development, System Studies, Urban Distribution, Rural Electrification.

Reliability and Quality: Reliability Models, System Reliability, Reliability and Quality Planning, Functional Zones, Generation Reliability Planning Criteria, Transmission Reliability Criteria, Distribution Reliability, Reliability Evaluation, Grid Reliability, Quality of Supply. ■

Module-5

Demand-Side Planning: Demand Response, Demand – Response Programmes, Demand– Response Technologies, Energy Efficiency, Energy - Economical Products, Efficient – Energy Users, Supply – Side Efficiency, Energy Audit.

Electricity Market: Market Principles, Power Pool, Independent System Operator, Distribution System Operator, Power Markets, Market Rules, Bidding, Trading, Settlement System, Merchant Power, Differential Electricity, Congestion Management, Ancillary Services, Hedging, Smart Power Market. ■

Course Outcomes: At the end of the course the student will be able to:

- Discuss primary components of power system planning, planning methodology for optimum power system expansion and load forecasting.
- Understand economic appraisal to allocate the resources efficiently and appreciate the investment decisions
- Discuss expansion of power generation and planning for system energy in the country, evaluation of operating states of transmission system, their associated contingencies and the stability of the system.
- Discuss principles of distribution planning, supply rules, network development and the system studies
- Discuss reliability criteria for generation, transmission, distribution and reliability evaluation and analysis, grid reliability, voltage disturbances and their remedies
- Discuss planning and implementation of electric –utility activities, market principles and the norms framed. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Textbook

1	Electric Power Planning	A. S. Pabla	McGraw Hill,	2nd Edition, 2016

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER – VIII			
ELECTRICAL POWER QUALITY (Professional Elective)			
Course Code	**18EE825**	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- Review definitions and standards of common power quality phenomena.
- Understand power quality monitoring and classification techniques.
- Investigate different power quality phenomena causes and effects.
- Understand different techniques for power quality problems mitigation.
- Understand the various power quality phenomenon, their origin and monitoring and mitigation methods.
- Understand the effects of various power quality phenomenon in various equipment's

Module-1

Introduction: Power quality-voltage quality, power quality evaluation procedures term and definitions: general classes of power quality problems, transients, long duration voltage variation, short duration voltage variations, voltage imbalance, waveform distortion, power quality terms. ■

Module-2

Voltage sags and interruptions: Sources of sags and interruptions, estimating voltage sag performance, fundamental principles of protection, motor starting sags.

Transient over voltages: Sources of transient over voltages, principles of over voltages protection, utility capacitor switching transients. ■

Module-3

Transient over voltages: Fundamentals of harmonics: Harmonic distortion, voltage versus transients, harmonic indexes, harmonic sources from commercial loads, harmonic sources from Industrial loads, effects of harmonic distortion, intra harmonics. ■

Module-4

Applied harmonics: Harmonic distortion evaluations, principles for controlling harmonics, harmonic studies, devices for controlling harmonic distortion, harmonic filters, standards of harmonics. ■

POWER QUALITY BENCHMARK: Introduction, benchmark process, power quality contract.

Module-5

Power quality benchmark: power quality state estimation, including power quality in distribution planning.

Distributed generation and quality: DG technologies, interface to utility system, power quality issues, interconnection standards. ■

Course Outcome: At the end of the course the student will be able to:

- Define Power quality; evaluate power quality procedures and standards.
- Estimate voltage sag performance; explain principles of protection and Sources of transient over voltages.
- Identify various sources of harmonics, explain effects of harmonic distortion.
- Evaluate harmonic distortion, control harmonic distortion.
- Estimate power quality in distribution planning. Identify power quality issues in utility system. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books

1.	Electric Power Quality	Dugan, Roger C, Mark F	McGraw-Hill professional	2003.

Reference Books

1.	Electric Power Quality	G.T.Heydt	Stars in a circle publications	1991.

2.	Understanding power quality problems voltage sags and interruptions	Math H. J. Bollen.	IEEE Press	2000
3.	Power quality in power systems and electrical machines	Ewald F Fuchs, Mohammad, A.S., Masoum	Academic Press, Elsevier	2009

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING **Choice Based Credit System (CBCS) and Outcome Based Education (OBE)** **SEMESTER – VII / VIII**			
INTERNSHIP			
Course Code	**18EEI85**	CIE Marks	40
Number of Practical Hours/Week	--	SEE Marks	60
Credits	**03**	Exam Hours	03

Course Learning Objectives:

Internship provide students the opportunity of hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objective are further,

- To put theory into practice.
- To expand thinking and broaden the knowledge and skills acquired through course work in the field.
- To relate to, interact with, and learn from current professionals in the field.
- To gain a greater understanding of the duties and responsibilities of a professional.
- To understand and adhere to professional standards in the field.
- To gain insight to professional communication including meetings, memos, reading, writing, public. ■

Internship: Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to acquire as much knowledge as possible without causing any inconvenience at the place of internship.

Seminar: Each student, is required to

- Present the seminar on the internship orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit the report duly certified by the external guide.

The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident. ■

Course Outcomes: At the end of the course the student will be able to:

- Gain practical experience within industry in which the internship is done.
- Acquire knowledge of the industry in which the internship is done.
- Apply knowledge and skills learned to classroom work.
- Develop a greater understanding about career options while more clearly defining personal career goals.
- Experience the activities and functions of professionals.
- Develop and refine oral and written communication skills. ■

Continuous Internal Evaluation

CIE marks : 40 Marks

i. Successful completion of Internship training in an organization and certification from competitive authority-20 marks

ii. Presentation and report -20 Marks

(based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairman. ■

Semester End Examination

SEE marks – 60 Marks based on presentation skill, participation in the question and answer session by the student to the examiners appointed by the University.■

Open Electives A/B

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING **Choice Based Credit System (CBCS) and Outcome Based Education (OBE)** **SEMESTER – VI**			
INDUSTRIAL SERVO CONTROL SYSTEMS(Open Elective)			
Course Code	**18EE651**	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To explain the evolution and classification of servos, with descriptions of servo drive actuators, amplifiers, feedback transducers, performance, and troubleshooting techniques.
- To discuss system analogs and vectors, with a review of differential equations.
- To discuss the concept of transfer functions for the representation of differential equations.
- To discuss mathematical equations for electric servo motors, both DC and brushless DC servo motors.
- To represent servo drive components by their transfer function, to combine the servo drive building blocks into system block diagrams.
- To determine the frequency response techniques for proper servo compensation. ■

Module-1

Servos: Introduction, Benefits of Servo Systems, Types of Servos - Evolution of Servo Drives, Classification of Drives, Components of Servos - Hydraulic/Electric Circuit Equations, Actuators—Electric,Actuators—Hydraulic,Amplifiers—Electric,Amplifiers—Hydraulic,Transducers (Feedback). ■

Module-2

Machine Servo Drives: Types of Drives, Feed Drive Performance.
Troubleshooting Techniques: Techniques by Drive, Problems: Their Causes and Cures.
Machine Feed Drives: Advances in Technology, Parameters for making Application Choices.
Application of Industrial Servo Drives: Introduction ,Physical System Analogs, Quantities and Vectors, Differential Equations for Physical Systems, Electric Servo Motor Transfer Functions and Time Constants, Transport Lag Transfer Function, Hydraulic Servo Motor Characteristics, General Transfer Characteristics. ■

Module-3

Generalized Control Theory: Servo Block Diagrams, Frequency-Response Characteristics and Construction of Approximate (Bode) Frequency Charts, Nichols Charts, Servo Analysis Techniques, Servo Compensation.
Indexes of Performance: Definition of Indexes of Performance for Servo Drives, Indexes of Performance for Electric and Hydraulic Drives. ■

Module-4

Performance Criteria: Percent Regulation, Servo System Responses.
Ser Plant Compensation Techniques: Dead-Zone Nonlinearity, Change-in-Gain Nonlinearity, Structural Resonances, Frequency Selective Feedback, Feed forward Control.
Machine Considerations: Machine feed drive Considerations, Ball Screw Mechanical Resonances and Reflected Inertias for Machine Drives. ■

Module-5

Machine Considerations: Drive Stiffness, Drive Resolution, Drive Acceleration, Drive Speed Considerations, Drive Ratio Considerations, Drive Thrust/Torque And Friction Considerations, Drive Duty Cycles. ■

Course Outcomes: At the end of the course the student will be able to:

- Explain the evolution and classification of servos, with descriptions of servo drive actuators, amplifiers, feedback transducers, performance, and troubleshooting techniques.
- Discuss system analogs, vectors and transfer functions of differential equations.
- Discuss mathematical equations for electric servo motors, both DC and brushless DC servo motors.
- Represent servo drive components by their transfer function, to combine the servo drive buildingblocks into system block diagrams.
- Determine the frequency response techniques for proper servo compensation.
- Explain perform indices and performance criteria for servo systems and discuss the mechanical considerations of servo systems.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Book

1	Industrial Servo Control Systems Fundamentals and Applications	George W. Younkin	Marcel Dekker	1st Edition, 2003

Reference Books

1	Servo Motors and Industrial Control Theory	Riazollah Firoozian	Springer	2nd Edition, 2014
2	DC SERVOS Application and Design with MATLAB	Stephen M. Tobin	CRC	1st Edition, 2011

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER –VI

PLC and SCADA (Open Elective)

Course Code	**18EE652**	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To explain advantages and disadvantages, main parts and their functions, basic sequence of operation of PLC.
- To describe the hardware components: I/O modules, CPU, memory devices, other support devices and the functions of PLC memory map.
- To describe program scan sequence, the communication of information to the PLC using different languages, internal relay instruction.
- To explain identification of common operating modes found in PLCs, writing and entering theladder logic programs.
- To define the functions of Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits and Latching Relays.
- To explain conversion of relay schematics into PLC ladder logic programs and writing PLC programs directly from narrative descriptions.
- To explain the functions of PLC counter instructions, applying combinations of counters and timers to control systems.
- To describe the function of selectable timed interrupt and fault routine files and use of temporary end instruction.
- To explain the execution of data transfer instructions, interruption of data transfer and data compare instructions.
- To explain the basic operation of PLC closed-loop control system, various forms of mechanical sequencers and their operations.
- To describe the operation of bit and word shift registers and develop programs that use shift registers.
- To discuss the operation of various processes, structures of control systems and the method of communication between different industrial processes. ∎

Module-1

Programmable Logic Controllers: Introduction, Parts of a PLC, Principles of Operation, Modifying the Operation, PLCs versus Computers, PLC Size and Application.

PLC Hardware Components: The I/O Section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O Specifications, The Central Processing Unit (CPU), Memory Design, Memory Types, Programming Terminal Devices, Recording and Retrieving Data, Human Machine Interfaces (HMIs).

Basics of PLC Programming: Processor Memory Organization, Program Scan, PLC Programming Languages, Relay-Type Instructions, Instruction Addressing, Branch Instructions, Internal Relay Instructions, Programming Examine If Closed and Examine If Open Instructions, Entering the Ladder Diagram, Modes of Operation ∎

Module-2

Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs: Electromagnetic Control Relays, Contactors, Motor Starters, Manually Operated Switches, Mechanically Operated Switches, Sensors, Output Control Devices, Seal-In Circuits, Latching Relays, Converting Relay Schematics into PLC Ladder Programs, Writing a Ladder Logic Program Directly from a Narrative Description.

Programming Timers: Mechanical Timing Relays, Timer Instructions, On-Delay Timer Instruction, Off-Delay Timer Instruction, Retentive Timer, CascadingTimers. ∎

Module-3

Programming Counters: Counter Instructions, Up-Counter, Down-Counter, Cascading Counters, Incremental Encoder-Counter Applications, Combining Counter and Timer Functions.

Program Control Instructions: Master Control Reset Instruction, Jump Instruction, Subroutine Functions, Immediate Input and Immediate Output Instructions, Forcing External I/O Addresses, Safety Circuitry, Selectable Timed Interrupt, Fault Routine, Temporary End Instruction, Suspend Instruction. ■

Module-4

Data Manipulation Instructions: Data Manipulation, Data Transfer Operations, Data Compare Instructions, Data Manipulation Programs, Numerical Data I/O Interfaces, Closed-Loop Control.

Math Instructions: Math Instructions, Addition Instruction, Subtraction Instruction, Multiplication Instruction, Division Instruction, Other Word-Level Math Instructions, File Arithmetic Operations. ■

Module-5

Sequencer and Shift Register Instructions: Mechanical Sequencers, Sequencer Instructions, Sequencer Programs, Bit Shift Registers, Word Shift Operations.

Process Control, Network Systems, and SCADA: Types of Processes, Structure of Control Systems, On/Off Control, PID Control, Motion Control, Data Communications, Supervisory Control and Data Acquisition (SCADA). ■

Course Outcomes: At the end of the course the student will be able to:

- Discuss history of PLC and describe the hardware components of PLC: I/O modules, CPU, memory devices, other support devices, operating modes and PLC programming.
- Describe field devices Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits, and Latching Relays commonly used with I/O module.
- Analyze PLC timer and counter ladder logic programs and describe the operation of different program control instructions
- Discuss the execution of data transfer instructions, data compare instructions and the basic operation of PLC closed-loop control system.
- Describe the operation of mechanical sequencers, bit and word shift registers, processes and structure of control systems and communication between the processes. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Textbook

1	Programmable Logic Controllers	Frank D Petruzella	McGraw Hill,	4th Edition, 2011

Reference Book

1	Programmable Logic Controllers an Engineer's Guide	E A Parr	Newnes	3rd Edition, 2013
2	Introduction Programmable Logic Controllers	Gary Dunning	Cengage	3rd Edition, 2006

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER –VI			
RENEWABLE ENERGY RESOURCES(Open Elective)			
Course Code	**18EE653**	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy.
- To explain sun – earth geometric relationship, Earth – Sun Angles and their Relationships
- To discuss about solar energy reaching the Earth's surface and solar thermal energy applications.
- To discuss types of solar collectors, their configurations and their applications
- To explain the components of a solar cell system, equivalent circuit of a solar cell, its characteristics and applications.
- To discus benefits of hydrogen energy, production of hydrogen energy, storage its advantages and disadvantages.
- To discuss wind turbines, wind resources, site selection for wind turbine
- To discuss geothermal systems, their classification and geothermal based electric power generation
- To discuss waste recovery management systems, advantages and disadvantages
- To discuss biomass production, types of biomass gasifiers, properties of producer gas.
- To discuss biogas, its composition, production, benefits.
- To discuss tidal energy resources, energy availability, power generation.
- To explain motion in the sea wave, power associated with sea wave and energy availability and the devices
- for harnessing wave energy.

Module-1

Introduction: Causes of Energy Scarcity, Solution to Energy Scarcity, Factors Affecting Energy Resource Development, Energy Resources and Classification, Renewable Energy – Worldwide Renewable Energy Availability, Renewable Energy in India.

Energy from Sun: Sun- earth Geometric Relationship, Layer of the Sun, Earth – Sun Angles and their Relationships, Solar Energy Reaching the Earth's Surface, Solar Thermal Energy Applications. ■

Module-2

Solar Thermal Energy Collectors: Types of Solar Collectors, Configurations of Certain Practical Solar Thermal Collectors, Material Aspects of Solar Collectors, Concentrating Collectors, Parabolic Dish – Stirling Engine System, Working of Stirling or Brayton Heat Engine, Solar Collector Systems into Building Services, Solar Water Heating Systems, Passive Solar Water Heating Systems, Applications of Solar Water Heating Systems, Active Solar Space Cooling, Solar Air Heating, Solar Dryers, Crop Drying, Space Cooing, Solar Cookers, Solar pond.

Solar Cells: Components of Solar Cell System, Elements of Silicon Solar Cell, Solar Cell materials, Practical Solar Cells, I – V Characteristics of Solar Cells, Efficiency of Solar Cells, Photovoltaic Panels, Applications of Solar Cell Systems. ■

Module-3

Hydrogen Energy: Benefits of Hydrogen Energy, Hydrogen Production Technologies, Hydrogen Energy Storage, Use of Hydrogen Energy, Advantages and Disadvantages of Hydrogen Energy, Problems Associated with Hydrogen Energy.

Wind Energy: Windmills, Wind Turbines, Wind Resources, Wind Turbine Site Selection. **Geothermal Energy:** Geothermal Systems, Classifications, Geothermal Resource Utilization, Resource Exploration, Geothermal Based Electric Power Generation, Associated Problems, environmental Effects. **Solid waste and Agricultural Refuse:** Waste is Wealth, Key Issues, Waste Recovery Management Scheme, Advantages and Disadvantages of Waste Recycling, Sources and Types of Waste, Recycling of Plastics. ■

Module-4

Biomass Energy: Biomass Production, Energy Plantation, Biomass Gasification, Theory of Gasification, Gasifier and Their Classifications, Chemistry of Reaction Process in Gasification, Updraft, Downdraft and Cross-draft Gasifiers, Fluidized Bed Gasification, Use of Biomass Gasifier, Gasifier Biomass Feed Characteristics, Applications of Biomass Gasifier, Cooling and Cleaning of Gasifiers.

Biogas Energy: Introduction, Biogas and its Composition, Anaerobic Digestion, Biogas Production, Benefits of Biogas, Factors Affecting the Selection of a Particular Model of a Biogas Plant, Biogas Plant Feeds and their Characteristics.

Tidal Energy: Introduction, Tidal Energy Resource, Tidal Energy Availability, Tidal Power Generation in India, Leading Country in Tidal Power Plant Installation, Energy Availability in Tides, Tidal Power Basin, Turbines for Tidal Power, Advantages and Disadvantages of Tidal Power, Problems Faced in Exploiting Tidal Energy. ■

Module-5

Sea Wave Energy: Introduction, Motion in the sea Waves, Power Associated with Sea Waves, Wave Energy Availability, Devices for Harnessing Wave Energy, Advantages and Disadvantages of Wave Power.

Ocean Thermal Energy: Introduction, Principles of Ocean Thermal Energy Conversion (OTEC), Ocean Thermal Energy Conversion plants, Basic Rankine Cycle and its Working, Closed Cycle, Open Cycle and Hybrid Cycle, Carnot Cycle, Application of OTEC in Addition to Produce Electricity, Advantages, Disadvantages and Benefits of OTEC. ■

Course Outcomes: At the end of the course the student will be able to:

- Discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy.
- Outline energy from sun, energy reaching the Earth's surface and solar thermal energy applications.
- Discuss types of solar collectors, their configurations, solar cell system, its characteristics and their applications.
- Explain generation of energy from hydrogen, wind, geothermal system, solid waste and agriculture refuse.
- Discuss production of energy from biomass, biogas.
- Summarize tidal energy resources, sea wave energy and ocean thermal energy. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Textbook				
1	Nonconventional Energy Resources	ShobhNath Singh	Pearson	1st Edition, 2015
Reference Books				
1	Nonconventional Energy Resources	B.H. Khan	McGraw Hill	3rd Edition,
2	Renewable Energy; Power for a sustainable Future	Godfrey Boyle	Oxford	3rd Edition, 2012
3	Renewable Energy Sources: Their Impact on global Warming and Pollution	TasneemAbbasi S.A. Abbasi	PHI	1st Edition, 2011

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER –VI

TESTING AND COMMISSIONING OF POWER SYSTEM APPARATUS (Open Elective)

Course Code	**18EE654**	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- Describe the process to plan, control and implement commissioning of electrical equipment's.
- Differentiate the performance specifications of transformer and induction motor.
- Demonstrate the routine tests for synchronous machine, induction motor, transformer & switchgears.
- Identification of tools and equipment's used for installation and maintenance of electrical equipment.
- Explain the operation of an electrical equipment's such as isolators, circuit breakers, insulators and switchgears.

Module-1

Electrical Tools, accessories: Tools, Accessories and Instruments required for Installation, Maintenance and Repair Work, India Electricity Rules, Safely Codes Causes and Prevention of Accidents, Artificial Respiration, Workmen's Safety Devices.

Transformers: Installation, Location Site Selection, Foundation Details, Code of Practice for Terminal Plates, Polarity and Phase Sequence, Oil Tanks, Drying of Winding sand General Inspection. Commissioning Tests As Per National and International Standards - Volts Ratio Earth Resistance, Oil Strength, Insulation Tests, Impulse Tests Polarizing Index, Load Temperature Rise Tests. Specific Tests for Determination of Performance Curves like Efficiencies, Regulation Etc., Determination Mechanical Stress Under Normal and Abnormal Conditions. ■

Module-2

Synchronous Machines: Specifications as per BIS Standards. Installation - Physical Inspection, Foundation Details, Alignments, Excitation Systems, Cooling and Control Gear, Drying Out. Commissioning Tests - Insulation, Resistance Measurement of Armature and Field Windings, Wave Form and Telephone Interference Tests, Line Charging Capacitance. Performance Tests -Various Tests to Estimate the Performance of Generator Operations, Slip Test, Maximum Lagging Current, Maximum Reluctance Power Tests, Sudden Short Circuit Tests, Transient Sub Transient Parameters, Measurement of Sequence Impedances, Capacitive Reactance, and Separation Of Losses,

Temperature Rise Test, and Retardation Tests. Factory Tests -Gap Length, Magnetic Eccentricity, Balancing Vibrations, Bearing Performance. ■

Module-3

Induction Motor: Specifications. Installation- Location of Motors and its Control Apparatus, Shaft Alignment for Various Coupling, Fitting of Pulleys and Coupling, Drying of Windings. Commissioning Tests -Mechanical Tests For Alignment, Air Gap Symmetry, Tests for Bearings, Vibrations and Balancing. Specific Tests -Performance and Temperature Raise Tests, Stray Load Losses, Shaft Alignment, Re-Writing and Special Duty Capability, Site Test. ■

Module-4

Laying of Underground Cables: Inspection, Storage, Transportation and Handling of Cables, Cable Handing Equipment, Cable Laying Depths and Clearances from other Services such as Water Sewerage, Gas, Heating and other Mains, Series of Power and Telecommunication Cables and Coordination with these Services, Excavation of Trenches, Cable Jointing and Terminations Testing and Commissioning. Location of Faults using Megger, Effect of Open or Loose Neutral Connections, Provision of Proper Fuses on Service Lines and Their Effect on System, Causes and Dim, and Flickering Lights. ■

Module-5

Switchgear and Protective Devices: Standards, Types, Specification, Installation, Commissioning Tests, Maintenance Schedule, Type and Routine Tests.

Domestic Installation: Introduction, Testing of Electrical Installation of a Building, Testing of Insulation Resistance to Earth, Testing of Insulation and Resistance between Conductors Continuity or Open Circuit Test, Short Circuit Test, Testing of Earthing Continuity, Location of Faults, IE Rules for Domestic Installation. ■

Course Outcomes: At the end of the course the student will be able to:

- Describe the process to plan, control and implement commissioning of electrical equipment's.
- Differentiate the performance specifications of transformer and induction motor.
- Demonstrate the routine tests for synchronous machine, induction motor, transformer & switchgears.
- Describe corrective and preventive maintenance of electrical equipment's.
- Explain the operation of an electrical equipment's such as isolators, circuit breakers, induction motor and synchronous machines. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text/ Reference Books

1	Testing, Commissioning, Operation and	S. Rao	Khanna Publishers	6th Edition, 19th Reprint, 2015
2	Testing and Commissioning of Electrical	R.L.Chakrasali	Prism Books Pvt Ltd	1st Edition,2014
3	Preventive Maintenance of Electrical Apparatus	S.K.Sharotri	Katson Publishing House	1st Edition, 1980
4	Handbook of Switchgears	BHEL	McGraw Hill	1st Edition, 2005
5	Transformers	BHEL	McGraw Hill	1st Edition, 2003
6	The J&P Transformer Book	Martin J. Heathcote	Newnes	12th Edition, 1998

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER –VII

INDUSTRIAL MOTORS & CONTROL (Open Elective)

Course Code	**18EE751**	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To provide basic principles and types of electrical motors.
- To study DC motors, performance, control and applications and Selection of the motors for a particular application.
- To study types Starting and Breaking of Motors
- To study different types of Speed Control of Motors
- To study Selection of Motors for Industrial Drives & Economic Selection of Electric Motors
- To impart the knowledge of Electrical Drawings, Installation, Maintenance & Safety of Electrical Installation. ■

Module-1

Types of Motors DC Motor: Motor Principle, Back emf, Equivalent Circuit of DC Motor Armature, Torque, Types, Characteristics of Shunt Series and Compound Motors.
3 phase Induction Motor: Principle of operation, Speed and Slip, Frequency of Rotor Voltage and Current, Torque of an Induction Motor, Maximum Torque, Torque Slip and Torque Slip Characteristics.
Single Phase Induction Motors: Production of Rotating Field, Single Phase Induction Motor Principle, Types of Single Phase Induction Motors. ■

Module-2

Starting and Breaking of Motors:
DC Motor: Necessity of Starter, Three Point and Four Point Starter, Representation of on four quadrant diagram, Electric breaking of DC motor, Regenerative Breaking and Plugging or Reverse Current Breaking.
Induction Motor: Staring of Gauge Motors – DOL, Star Delta, Auto Transformers Starters, Slip Ring Induction Motors Starters, Regenerative braking of induction motor, Plugging Braking of induction motor. ■

Module-3

Speed Control of Motors:
DC Motor: Rheostatic Control, Field Flux Control, Armature Voltage Control (Ward –Leonard Method) and Solid State Control (Block Diagram Approach Only).
Induction Motor: Pole Changing Method, Stator Voltage Control, Rotor Resistance Control, Slip Energy Recovery. ■

Module-4

Selection of Motors for Industrial Drives and Applications:
Selection of Motors: Introduction, Power Range for Motors and Drives, Load Requirements – Torque–Speed Characteristics, General Application Considerations. Economic Selection of Electric Motors.
Motor Applications: Motors for Textile, Machine Tool, Cranes, Compressors, Water Supply, Coal Mining and Rolling Mills applications. ■

Module-5

Electrical Installation for Motors: Introduction, Motor Terminal Connections, Motor Nameplate Details, Important Consideration Regarding Motor Installation Wiring, Determination of Input Power and Current, Determination of Rating of Cables. Determination of Rating of Fuses, Determination of Size of Conduit, Distribution Board, Main Switch and Starter, Problems on Estimation of material required of Motor Installation.
Maintenance and Safety: Motor Maintenance, Troubleshooting Motors, Protection of motor for specific conditions, maintenance of motors, Motor faults and causes. Contactor Ratings: NEMA Ratings, IEC Ratings, Protecting against Electrical Shock, Grounding and Bonding, Lockout and Tagout, Electrical Codes and Standards. ■

Course Outcomes: At the end of the course, the student will be able to

- Basic principles of electric motors explain the procedure of selecting rating of the motor for any application.
- Classify DC motors, explain the torque speed characteristics and select a motor for an application.
- Classify Induction Motors, explain the torque speed characteristics and select a motor for an application.
- Explain the types of Starting and Breaking of Motors
- Explain the different types of Speed Control of Motors
- Selection of Motors for Industrial Drives & Economic Selection of Electric Motors.
- Discuss Electrical Drawings, Installation, Maintenance & Safety ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	Electric Machines	Ashfaq Husain	Dhanpat Rai & Co	2013
2	Electric Motor Drives, Fundamentals, Types and Applications	Austin Hughes	Elsevier ,Third edition	2006
3	Electrical motors applications and control.	M V Deshapande	PHI publications	2010
4	Electric Motors and Control Systems-Career Education	Frank Petruzella	McGraw-Hill Companies, Inc.	2010
5	A Course in Electrical Installation Estimating & Costing	J, B, Gupta	S. K. Kataria & Sons 9th Edition	2012

. E. ELECTRICAL AND ELECTRONICS ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER –VII			
SENSORS AND TRANSDUCERS (Open Elective)			
Course Code	**18EE752**	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To discuss need of transducers, their classification, advantages and disadvantages.
- To discuss working of different types of transducers and sensors.
- To discuss recent trends in sensor technology and their selection.
- To discuss basics of signal conditioning and signal conditioning equipment.
- To discuss configuration of Data Acquisition System and data conversion.
- To discuss the basics of Data transmission and telemetry.
- To explain measurement of various non-electrical quantities. ∎

Module-1

Sensors and Transducers: Introduction, Classification of Transducers**,** Advantages and Disadvantages of Electrical Transducers, Transducers Actuating Mechanisms, Resistance Transducers, Variable Inductance Transducers, Capacitive Transducers, Piezoelectric Transducers, Hall Effect Transducers, Thermoelectric Transducers, Photoelectric Transducers. ∎

Module-2

Sensors and Transducers (continued): Stain Gages, Load Cells, Proximity Sensors, Pneumatic Sensors, Light Sensors, Tactile Sensors, Fiber Optic Transducers, Digital Transducers, Recent Trends – Smart Pressure Transmitters, Selection of Sensors, Rotary – Variable Differential Transformer, Synchros and Resolvers, Induction Potentiometers, Micro Electromechanical Systems. ∎

Module-3

Signal Condition: Introduction, Functions of Signal Conditioning Equipment, Amplification, Types of Amplifiers, Mechanical Amplifiers Fluid Amplifiers, Optical Amplifiers, Electrical and electronic Amplifiers.

Data Acquisition Systems and Conversion: Introduction, Objectives and Configuration of Data Acquisition System, Data Acquisition Systems, Data Conversion. ∎

Module-4

Data Transmission and Telemetry: Data/Signal Transmission, Telemetry.

Measurement of Non – Electrical Quantities: Pressure Measurement

Module-5

Measurement of Non – Electrical Quantities (continued): Temperature Measurement, Flow Measurement – Introduction, Electromagnetic Flow meters, Ultrasonic Flow Meters, Thermal Metes, Wire Anemometers. Measurement of Displacement, Measurement of Velocity/ Speed, Measurement of Acceleration, Measurement of Force, Measurement of Torque, Measurement of Shaft Power, Measurement of Liquid Level, Measurement of Viscosity. ∎

Course Outcomes: At the end of the course the student will be able to:

- Classify the transducers and explain the need of transducers, their classification, advantages and disadvantages.
- Explain the working of various transducers and sensors.
- Outline the recent trends in sensor technology and their selection.
- Analyze the signal conditioning and signal conditioning equipment.
- Illustrate different configuration of Data Acquisition System and data conversion.
- Show knowledge of data transmission and telemetry.
- Explain measurement of non-electrical quantities -temperature, flow, speed, force, torque, power and viscosity. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	Electrical and Electronic Measurements and instrumentation	R.K Rajput	S. Chand	3rd Edition, 2013.

Reference Books

1	A Course in Electronics and Electrical Measurements and Instruments	J.B. Gupta	Katson Books	13th Edition, 2008
2	A Course in Electrical and Electronic Measurements and Instrumentation	A. K. Sawheny	DhanpatRai	2015

. E. ELECTRICAL AND ELECTRONICS ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER –VII			
ELECTRIC VEHICLES (Open Elective)			
Subject Code	**18EE753**	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To Understand the fundamental laws and vehicle mechanics.
- To Understand working of Electric Vehicles and recent trends.
- Ability to analyze different power converter topology used for electric vehicle application.
- Ability to develop the electric propulsion unit and its control for application of electric vehicles. ■

Module-1

Vehicle Mechanics

Roadway Fundamentals, Laws of Motion, Vehicle Kinetics, Dynamics of Vehicle Motion, Propulsion Power, Force-Velocity Characteristics, Maximum Gradability, Velocity and Acceleration, Constant FTR, Level Road, Velocity Profile, Distance Traversed, Tractive Power, Energy Required, Nonconstant FTR, General Acceleration, Propulsion System Design. ■

Module-2

Electric and Hybrid Electric Vehicles

Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains. ■

Module-3

Energy storage for EV and HEV

Energy storage requirements, Battery parameters, Types of Batteries, Modelling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, PEMFC and its operation, Modelling of PEMFC, Supercapacitors. ■

Module-4

Electric Propulsion

EV consideration, DC motor drives and speed control, Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration and control of Drives. ■

Module – 5

Design of Electric and Hybrid Electric Vehicles

Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components, power rating of traction motor, power rating of engine/generator, design of PPS Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train, design of engine power capacity, design of electric motor drive capacity, transmission design, energy storage design. ■

Course Outcomes: At the end of the course the student will be able to:

- Explain the roadway fundamentals, laws of motion, vehicle mechanics and propulsion system design.
- Explain the working of electric vehicles and hybrid electric vehicles in recent trends.
- Model batteries, Fuel cells, PEMFC and super capacitors.
- Analyze DC and AC drive topologies used for electric vehicle application.
- Develop the electric propulsion unit and its control for application of electric vehicles.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Books

1	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design	M. Ehsani, Y. Gao, S. Gay and Ali Emadi	CRC Press	2005
2	Electric and Hybrid Vehicles: Design Fundamentals	Iqbal Husain	CRC Press	2003

Reference Books

1	Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles	Sheldon S. Williamson	Springer	2013
2	Modern Electric Vehicle Technology	C.C. Chan and K.T. Chau	OXFORD University	2001
3	Hybrid Electric Vehicles Principles And Applications With Practical Perspectives	Chris Mi, M. Abul Masrur, David Wenzhong Gao	Wiley Publication	2011

B . E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER –VII

ELECTRICAL ENERGY CONSERVATION AND AUDITING (Open Elective)

Subject Code	**18EE754**	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- Understand the current energy scenario and importance of energy conservation.
- Understand the methods of improving energy efficiency in different electrical systems.
- Realize energy auditing.
- Explain about various pillars of electricity market design.
- To explain the scope of demand side management, its concept and implementation issues and strategies.

Module-1

Energy Scenario: Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features. ■

Module-2

Energy Efficiency in Electrical Systems: Electricity billing, Electrical load management and maximum demand Control, Maximum demand controllers; Power factor improvement, Automatic power factor controllers, efficient operation of transformers, energy efficient motors, Soft starters, Variable speed drives; Performance evaluation of fans and pumps, Flow control strategies and energy conservation opportunities in fans and pumps, Electronic ballast, Energy efficient lighting and measures of energy efficiency in lighting system. ■

Module-3

Energy auditing: Introduction, Elements of energy audits, different types of audit, energy use profiles measurements in energy audits, presentation of energy audit results. ■

Module-4

Electricity vis-à-vis Other Commodities: Distinguishing features of electricity as a commodity, Four pillars of market design: Imbalance, Scheduling and Dispatch, Congestion Management, Ancillary Services. Framework of Indian power sector and introduction to the availability based tariff (ABT). ■

Module-5

Energy Audit Applied to Buildings: Energy – Saving Measures in New Buildings, Water Audit, Method of Audit, General Energy – Savings Tips Applicable to New as well as Existing Buildings. Demand side Management: Scope of DSM, Evolution of DSM concept, DSM planning and Implementation, Load management as a DSM strategy, Applications of Load Control, End use energy conservation, Tariff options for DSM. ■

Course Outcomes: At the end of the course the student will be able to:

- Analyze about energy scenario nationwide and worldwide , also outline Energy Conservation Act and its features.
- Discuss load management techniques and energy efficiency.
- Understand the need of energy audit and energy audit methodology.
- Understand various pillars of electricity market design.
- Conduct energy audit of electrical systems and buildings.
- Show an understanding of demand side management and energy conservation. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Books

1	Energy Management Handbook	W.C. Turner	Publisher John Wiley and Sons
2	Energy Efficient Electric Motors and Applications	H.E. Jordan	Plenum Pub. Corp
3	Energy Management Author Publisher	W. R. Murphy, G. Mckay	Butterworths

Reference Books

1	Energy Science Principles, Technologies and Impact,	J. Andrews, N. Jelley	Oxford University Press.
2	Market operations in power systems: Forecasting, Scheduling, and Risk Management,	Shahedepour M.,Yamin H., Zuyi Li.	John Wiely & Sons, New York
3	Energy Conservation	Diwan, P.	Pentagon Press (2008)

Semester: I

Course Name: MANAGEMENT AND ORGANIZATION BEHAVIOR

Course Code	**22MBA11**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:2**	**SEE Marks**	**50**
Credits	**04**	**Exam Hours**	**03**

Pre-requisites: Basic knowledge on management practices, insights on business operations, basics of psychology.

Course objectives:

1. To emphasis the fundamental concepts and principles of management in business situations.
2. To educate the function and applications of management.
3. To teach the concepts of employee behavior and its importance in organization.
4. To instruct process of group dynamics and managing teams.
5. To familiarize on the dynamics of cultural impact and managing the employee stress.

Module – 1

Introduction to Management

Definition,Scope of Management,Objectives, functions of management, administration vs. management, Evolution of management thought, types of managers, difference between manager and leader, Henry Mintzberg managerial roles, Managerial Skills, Managerial Competencies, Fayol's Fourteen Principles, Recent trends in Management.

9hours(RBT Levels:**L1, L2, L3**)

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars

Skill Enrichment Exercise: Explore on industry specific management skills required for effective leadership

Module - 2

Functions of Management

Planning: Meaning of planning, Nature of planning, Objectives, Types of Plans & the planning process, MBO, Decision making, Process of decision making, Types, Techniques in decision making.

Organizing: organization structure, formal Vs informal organizations, principles of organizations-chain of command, span of control, decentralization Vs Centralization, virtual organizations.

Directing: Definitions, Importance, Elements of Directing, and Principles of Directing.

Controlling: Need for controlling, Controlling Process, Types of control, Techniques of Managerial Control, Guidelines for Effective Control.

12 Hours (RBT Levels: **L1, L2, L3, L4**)

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars

Skill Enrichment Exercise: Perceive the four functions of management & learn how you can develop and use these skills to help advance your education and career goals.

Module – 3

Understanding Organization Behavior

Organizational Behavior: Introduction, definition, fundamental principles of OB, challenges and opportunities, Foundations of Individual Behavior.

Personality- Meaning, Factors Influencing Personality, Traits of personality, Big Five Personality Traits, Myers–Briggs Type Indicator (MBTI), Personality Tools and Tests. **Perception-**Meaning, Perceptual Process, Factors Influencing Perception, Perception and Decision-making **Attitude –** Meaning, Components, Relation between attitude and behavior, Changing Attitudes in the Workplace. **Motivation:** Definitions, importance of motivation, Process of Motivation (Cycle of Motivation), Types, Theories of motivation, Application of motivational theories. 12Hours (RBT Levels: **L2, L3, L4, L5**)
Teaching-Learning Process:
Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars **Skill Enrichment Exercise:** Build your OB Toolbox to extend your OB skills, Compare successful companies effective OB practices employed.

Module – 4

Managing Human at Work
Group Dynamics- Meaning of Group, Group Characteristics, Classification of Groups, Models of Group Development, Meaning of Group Dynamics, Impact of Group on Individual's Behaviour, Impact of External Factors on Group Behaviour. **Teamwork-** Teams meaning, Team Characteristics, Teams Versus Groups, Teamwork, Processes of Teamwork, Types of Teams, Reasons for Team Failure, Creating Effective Teams. 9Hours (RBT Levels: **L2, L3, L4, L5**)
Teaching-Learning Process:
Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars **Skill Enrichment Exercise:** Invest in building effective relationships, Teamwork Takes to the Sky: The Case of General Electric.

Module – 5

Organizational Culture and Stress Management
Culture: Definitions of Organizational Culture, Characteristics, Types, Levels, Strong versus Weak Culture,Changing, Changing Organizational Culture. **Stress Management-**Definitions, Understanding Stress, Relationbetween Stress and Performance, Level, Signs and Symptoms of Stress, Types of Stress, Causes of Stress,Managing Stress. 10Hours (RBT Levels: **L3, L4, L5, L6**)
Teaching-Learning Process:
Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars **Skill Enrichment Exercise:** Recognize the positive and negative aspects of power and politics. Immerse yourself in different cultures & develop openness to different experiences. Focus on Power: The Case of Steve Jobs

Course Outcomes:
CO1: Apply the concepts & principles of management in building manager qualities.
CO2: Analyze the various functions of management and appropriate its business application.

CO3: Evaluate the OB practices of employees using various personality tools and tests
CO4: Design the functioning of Group dynamics and in building effective teams.
CO5: Develop various dimensions in creating organization culture and overcome stress management.

Assessment Details

CIE:

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Essentials of Management	Koontz	McGraw Hill	8e, 2014
2	Management and Organizational Behavior	K.Purushotha ma& H. H Ramesha	Himalaya Publishing House	Latestedition
3	Organizational behaviour	Stephen P Robbins, Timothy	Pearson	14e, 2012
Reference Books				
1	Principles of Management	Ramesh B. Rudani	Tata McGraw-Hill	2013
2	Masters of Management Thought	MahanandCharati& M MMunshi	Swapna Book House	2015
3	Organizational behavior: Amodern approach	Arun Kumar and Meenakshi	Vikas Publishing House	2011.

e- Resources:

1. https://www.tandfonline.com/toc/worg20/current
2. https://managementhelp.org/
3. https://openstax.org/details/books/organizational-behavior
4. https://opentextbc.ca/organizationalbehavioropenstax/

Semester: I

Course Name: MANAGERIAL ECONOMICS

Course Code	**22MBA12**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:2**	**SEE Marks**	**50**
Credits	**04**	**Exam Hours**	**03**

Pre-requisites:

- Knowledge of Basic Economic concepts
- Knowledge of Indian Economy
- Knowledge of primary, secondary and tertiary sector

Course objectives:

1. To familiarize the fundamentals and theories of managerial economics.
2. To provide insights of demand and elasticity concepts in relation to firm and industry.
3. To teach fundamentals of Production and Cost concepts in Business scenario.
4. To emphasize the concepts of Market structure, Pricing, Profit strategies
5. To Educate the basics of Micro and Macro Economic concepts

Module – 1

Managerial Economics: Meaning, Nature, Scope, & Significance, Uses of Managerial Economics, Role and Responsibilities of Managerial Economist. Theory of the Firm: Firm and Industry, Objectives of the firm, alternate objectives of firm. Managerial theories: Baumol's Model, Marris's Hypothesis, Williamson's Model.

10 Hours (RBT Levels: L1,L2,L3)

Teaching-Learning Process:

Pedagogy: Chalk and talk method, PowerPoint Presentation, YouTube videos
Skill Enrichment Exercises: Learning Insights of Economic Gurus, Case Study

Module - 2

Law of Demand, Exceptions to the Law of Demand, Elasticity of Demand –Classification of Price, Income & Cross elasticity, Advertising and promotional elasticity of demand. Uses of elasticity of demand for Managerial decision making, Measurement of elasticity of demand. Law of supply, Elasticity of supply, Demand forecasting: Meaning & Significance, Methods of demand forecasting. (Simple problems).

10 Hours (RBT Levels: L1,L2,L3,L4)

Teaching-Learning Process:

Pedagogy: Chalk and talk method, PowerPoint Presentation, Using MS –Excel for Problems
Skill Enrichment Exercises: Mini Case Study on Demand and Supply Using MS-Excel

Module – 3

Concepts of Production, production function with one variable input - Law of Variable Proportions. Production function with 2 variable inputs and Laws of returns to scale, Indifference Curves, ISO-Quants & ISO-Cost line, Least cost combination factor, Economies of scale, Diseconomies of scale. Technological progress and production function. Types of cost, Cost curves, Cost – Output Relationship in the short run and in the long run, LAC curve. **Break Even Analysis** – Meaning, Assumptions, Determination of BEA, Limitations, Uses of BEA in Managerial decisions (with simple Problems).

10 Hours (RBT Levels:L2,L3,L4,L5)

Teaching-Learning Process:

Pedagogy: Chalk and talk method, Power point presentation
Skill Enrichment Exercises: Problems on BEP Using MS-Excel

Module – 4

Perfect Competition, Features, Determination of price under perfect competition, Monopoly: Features, Pricing under monopoly, Price Discrimination. Monopolistic Competition: Features, Pricing Under monopolistic competition, Product differentiation. Oligopoly: Features, Kinked demand Curve, Cartels, Price leadership. **Descriptive Pricing Approaches:** Full cost pricing, Product line pricing, **Pricing Strategies**: Price Skimming, Penetration Pricing, Loss leader pricing, Peak Load pricing. 10 Hours (RBT Levels: L2,L3,L4,L5)
Teaching-Learning Process:
Pedagogy: Chalk and Talk method, Power point presentation **Skill Enrichment Exercises:** Mini Project on Market Structures and Pricing

Module – 5

Nature, Scope, Structure of Indian Business Environment – Internal and External Environment. Political and Legal Environment, Economic Environment, Socio – Cultural Environment, Global Environment **Basic Macro Economic Concepts:** Open and Closed Economies, Primary, secondary and Tertiary sectors and their contribution to the economy. Measuring GDP and GDP Growth rate, Components of GDP. **Industrial Policies and Structure:** A critical look at Industrial Policies of India, New Industrial Policy 1991; - Private Sector- Growth, Problems and Prospects, SMEs –Significance in Indian economy-problems and prospects. **Fiscal policy and Monetary Policy. Foreign Trade:** Trends in India's Foreign Trade, Impact of WTO on India's Foreign Trade. 10 Hours (RBT Levels:L3,L4,L5,L6)
Teaching-Learning Process:
Pedagogy: Chalk and Talk method, YouTube videos, Power point presentations **Skill Enrichment Exercises:** Budget Analysis

Course Outcomes:

CO1: To apply the basic concepts of managerial economics in business Scenario.
CO2: To analyze the nature of demand and supply conditions to firm and industry.
CO3: To evaluate the Production and Cost strategies with business environment.
CO4: To design the strategies for Market competitions and Profit analysis.
CO5: To communicate the micro and macroeconomic concepts with reference to firm and industry.

Assessment Details

CIE :

(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be

proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 80 percent theory and 20 percent problems in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Managerial Economics	Geethika, Ghosh & Choudhury	McGraw Hill	2/e, 2011
2	Managerial Economics	D.M Mithani	HPH	2016
Reference Books				
1	Managerial Economics	R. Panneerselvam, P. Sivasankaran, P. Senthilkumar	Cengage	2015
2	Managerial Economics	H.L Ahuja Samuelson & Marks	S.Chand	2014
3	Managerial Economics	Samuelson & Marks	Wiley	5/e, 2015

e-Resources:

1. **https://www.youtube.com/watch?v=RaXQ8wQ6TUs**
2. **https://www.youtube.com/watch?v=g_Q_agzFXi0**
3. **https://www.youtube.com/watch?v=ycyMktNFZ88**
4. **https://www.youtube.com/watch?v=vLPpF0hunwc**

Semester: I

Course Name: ACCOUNTING FOR MANAGERS

Course Code	**22MBA13**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:2**	**SEE Marks**	**50**
Credits	**04**	**Exam Hours**	**03**

Pre-requisites:

- Basic Knowledge of mathematics.
- Fundamentals of Economics.
- Awareness of business scenario.
- Awareness of Government policies

Course objectives:

1. To understand the fundamental accounting concepts, need for accounting & Ind AS.
2. To explain the concepts of business transactions for identifying , recording & posting.
3. To prepare basic financial statements using the modern formats of Companies Act.
4. To describe the application of tools for measuring the company's financial statements using MS-Excel.
5. To utilize the concepts of standard costing and variance analysis for managerial decision making.

Module – 1

Introduction to Accounting:
Financial Accounting: Meaning and Need for accounting, Types of Accounting, Concepts and Conventions of Accounting, Concept of expenses& income ;capital and revenue, Ind-AS.

6 Hours (RBT Levels: L1,L2,L3)

Teaching-Learning Process:

Pedagogy: PowerPoint Presentation,Case Study.
Skill Enrichment Exercises: Visit the ICAI websites and study and analyze various AS and IFRS.

Module - 2

Accounting –recording, classifying &analyzing:
Journal, Ledgers, differences between journal and ledger, Trial balance, differences between trial balance and balance sheet. Bank reconciliation Statements-concept and analysis.

10 Hours (RBT Levels: L1,L2,L3,L4)

Teaching-Learning Process:

Pedagogy: PowerPoint Presentation,Case Study.
Skill Enrichment Exercises: Collect the information from Bank Passbook and Cash book details and learn the process of BRS.

Module – 3

Financial Statements:
Concept of financial statements, Income Statements, Balance Sheets, adjustments of financial statements. Concept of Window dressing. Preparation of final accounts of companies in vertical form as per Companies Act of 2013.

10 Hours (RBT Levels: L2,L3,L4,L5)

Teaching-Learning Process:

Pedagogy: PowerPoint Presentation,Case Study.
Skill Enrichment Exercises: Visit various company websites and download previous year question papers to understand the formats to prepare the financial statements.

Module – 4

Analysis of Financial Statements:
Meaning and Purpose of Financial Statement Analysis, Financial Ratio Analysis and Cash flow Statement (indirect method).

10 Hours (RBT Levels:L2,L3,L4,L5,L6)

Teaching-Learning Process:

Pedagogy: PowerPoint Presentation,Case Study.
Skill Enrichment Exercises: Individual student should analyze the Balance sheets of blue chip companies using Excel sheet.

Module – 5

Accounting for managerial decision making:
Scope, Purpose of Management Accounting;
Marginal costing–concept and areas of application of marginal costing (theory only)
Standard costing-Theory& application in Managerial Decision-Making.

12 Hours (RBT Levels: L2,L3,L4,L5,L6)

Teaching-Learning Process:

Pedagogy: PowerPoint Presentation,Case Study.
Skill Enrichment Exercises: Individual student should collect the data relating to Variance analysis & make appropriate decisions.

Course Outcomes: At the end of the course the student will be able to:
CO1: Apply theoretical knowledge of accounting for relevant business transactions.
CO2: Analyze the transactions using accounting process in business.
CO3: Preparation & evaluation of financial statements of varied companies.
CO4: Design the Cash flow statements & analyze the ratios using MS-Excel
CO5: Communicate the financial situation of business units using Variance analysis

Assessment Details

CIE :

(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, SelfE-Learning withCertifications and other cooperative and problem based learning.

SEE:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50. The question paper will have 8 full questions carrying equal marks.

- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions, selecting four full question from question number one to seven and question number eight is compulsory.
- 40 percent theory and 60 percent problems in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Accounting for Management-Text & Cases	S.K.Bhattacharya& John Dearden	Vikas Publishing House Pvt. Ltd.	3e, 2018
2	Financial Accounting	S.N.Maheshwari, Suneel K. Maheshwari, Sharad K. Maheshwari	Vikas Publishing House Pvt. Ltd.	6e, 2018
3	Computerized Accounting	NeerajGoyal, RohitSachdeva	Kalyani Publishers	1e, 2018
Reference Books				
1	Accounting for Managers	J.MadeGowda	Himalaya Publishing House	le, 2007
2	Financial Accounting for Management	N. Ramachandran, Ram Kumar Kakani.	McGraw Education (India) Private Limited	4e., 2016
3	Management Accounting: Text, Problems and Cases	MY Khan, PK Jain	Tata McGraw-Hill Education	7e, 2007
4	Accounting and Finance for Non finance Managers	Jai Kumar Batra	Sage Publications	le, 2018

e-Resources:

1. https://www.icai.org/post.html?post_id=17757
2. https://www.icai.org/post/icai-e-journal-main
3. https://www.icai.org/post/accounting-standards
4. https://www.ifrs.org/groups/international-accounting-standards-board/
5. https://icmai.in/icmai/index.php
6. https://www.aicpa.org/topic/accounting-financial-reporting
7. https://www.youtube.com/watch?v=cPhGI-in-bw
8. https://www.youtube.com/watch?v=76gMXQBnbps
9. https://www.youtube.com/watch?v=aE4JnjAx2Qc
10. https://www.youtube.com/watch?v=I0RiMWUCQ24
11. https://www.youtube.com/watch?v=0WgqlOAmdnc

Semester: I

Course Name: BUSINESS STATISTICS

Course Code	**22MBA14**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:2**	**SEE Marks**	**50**
Credits	**04**	**Exam Hours**	**03**

Pre-requisites: Familiar with Basic mathematical knowledge, Basic Logical reasoning and analytical thinking, communication and presentation skills.

Course objectives:
1. To teach the importance of descriptive statistics for various business data.
2. To educate the process and importance of correlation and regression in business.
3. To give insights on time series methods and its applications.
4. To familiarize the concepts of Hypothesis testing for inferential research findings.
5. Demonstrate the statistical tools for business situations using MS Excel.

Module – 1

Introduction of Statistics: Meaning, Function, Scope of statistics in business and industry, Measures of Central Tendency: Mean, Median Mode, Geometric mean, Harmonic mean. **Measures of Dispersion:** Concept of dispersion Absolute and relative measures of dispersion Range Coefficient of dispersion Quartile deviation mean deviation, variance, and standard deviation, respective absolute and relative measures. Application of measures of central tendency and dispersion for business decision making. .**10 Hours (RBT Levels: L1, L2, L3)**
Teaching-Learning Process:
Pedagogy: Chalk & Talk method, Case Study, Power point presentation, Solving Practical Problems. **Skill Enrichment Exercises:** Collecting real time data to measures of central tendency (mean, median & mode)

Module - 2

Correlation &Regression: Correlation, Types of correlation, Pearson's coefficient of correlation, Spearman's rank correlation coefficient, Properties of correlation coefficient, Regression: Meaning and types of regression equations, Derivation of regression equations, Properties of regression equations, regression of Y on line X & regression of X on Y. **10 Hours (RBT Levels: L1, L2, L3, L4)**
Teaching-Learning Process:
Pedagogy: Chalk & Talk method, Group discussion, Case Study, Power point presentation, Solving Practical Problems **Skill Enrichment Exercises:** Collect industry data and analyze using correlation and regression.

Module – 3

Time Series Analysis: Objectives, Variations In Time Series - Methods of Estimating Trend: Freehand Method - Moving Average Method - Semi-Average Method - Least Square Method. Methods of Estimating Seasonal Index: Method Of Simple Averages - Ratio To Trend Method - Ratio To Moving Average Method. **10 Hours (RBT Levels: L2, L3, L4, L5)**
Teaching-Learning Process:
Pedagogy: Chalk & Talk method, Group discussion, Case study, Power point presentation,

Solving Practical Problems
Skill Enrichment Exercises: Forecast sales and stock price trends using time series analysis.

Module – 4

Testing of Hypothesis: Hypothesis testing: Null and Alternative Hypotheses; Type I and Type errors; Testing of Hypothesis: one sample and two sample tests for means and proportions of larg samples (Z-test), one sample and two sample tests for means of small samples (T-test), F-test f two sample standard deviations. ANOVA: one-way and Two-way (Theory only)

10 Hours (RBT Levels: L2, L3, L4, L5)

Teaching-Learning Process:

Pedagogy: Chalk & Talk method, Group discussion, Case Study, Power point presentation, Solving Practical Problems
Skill Enrichment Exercises: Formulate a question or hypothesis that can be investigated through the collection and analysis of relevant information.

Module – 5

Computer Lab for Statistics: MS Excel: Introduction, layout of the excel application, Functions, Formulas, Data analysis using MS-Excel- Mean, Median, Mode, Geometric Mean, Harmonic mean, Standard Deviation, Correlation.

10 Hours (RBT Levels: L3, L4, L5, L6)

Teaching-Learning Process:

Pedagogy: Chalk & Talk method, , Power point presentation, Solve Practical Problems in computer Lab
Skill Enrichment Exercises: Students should undertake a mini project and generate the report using MS Excel.

Course Outcomes:
CO1: Apply the basic concepts of descriptive statistic techniques to visualize data systematically.
CO2:Analyze the business situations with appropriate use of decision making techniques.
CO3:Evaluate the business scenarios to predict solution by using time series techniques.
CO4: Design the research process for appropriate data analysis for inferential decisions.
CO5:Develop the various business application and models by the use of MS Excel tools.

Assessment Details

CIE :

(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.

- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 40 percent theory and 60 percent problems in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Fundamentals of Statistics	S C Gupta	Himalaya Publications	2012
2	Research Methodology	Ranjit Kumar	Sage Publications	2018
3	Parametric and Non Parametric Statistics	VimalaVeeraraghavan and Suhas	Sage Publication	2017
Reference Books				
1	Statistical Methods	Dr. S P Gupta	Sultan Chand Publications	2014
2	Research Methodology	C R Kothari	ViswaPrakasam Publication	2015
3	Business Research Methods	S.N.Murthy and U.Bhojanna.	Excel Books	2016

e-Resources:

1. http://103.5.132.213:8080/jspui/bitstream/123456789/1103/1/Business%20Statistics%20%28%20PDFDrive.com%20%29%20%282%29.pdf
2. http://103.5.132.213:8080/jspui/bitstream/123456789/1103/1/Business%20Statistics%20%28%20PDFDrive.com%20%29%20%282%29.pdf
3. https://d3bxy9euw4e147.cloudfront.net/oscms-prodcms/media/documents/IntroductoryBusinessStatistics-OP.pdf
4. https://mba.ind.in/forum/business-statistics-notes-mba-free-download-415321.html
5. https://onlinecourses.nptel.ac.in/noc20_mg23/preview

Semester: I

Course Name: Marketing Management

Course Code	**22MBA15**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:2**	**SEE Marks**	**50**
Credits	**04**	**Exam Hours**	**03**

Pre-requisites: Students should have basic knowledge of

- Market and business awareness
- Language Proficiency
- Good Communication and Presentation Skills
- Logical Reasoning

Course objectives:

1. To share basic fundamental concepts and importance of marketing & its relation to business environment.
2. To teach the insights on the concepts and factors influencing the consumer behavior and purchase decision making.
3. To familiarize the fundaments and use of segmentation, targeting and positioning as a marketer.
4. To educate the principles and elements affecting the pricing and marketing channel strategies.
5. To expound the significance of market promotional strategies to design the campaigns for products and services.

Module – 1

Introduction to Marketing: Nature and scope of marketing, Evolution, Various marketing orientations, Marketing Vs. Selling concepts, Consumer need, Want and demand concepts, Marketing Environment – Assessing the impact of micro and macro environment. Marketing challenges in the globalized economic scenario, Techniques used in Environment Analysis.

Market Basic Concepts: Customer value, Customer cost & its components, green marketing and green economy, Marketing Myopia, 3VconceptsofNirmalayaKumar, Emerging areas- Neuro Marketing, Sensory Marketing-conceptsonly, Corporate Social Responsibility, Social Responsibility of marketing.

10 Hours (RBT Levels: L1, L2, L3)

Teaching-Learning Process:

Pedagogy: Chalk & Talk Method, Group discussion, Seminar, Power point presentation, Case Study &Experiential exercises.

Skill Enrichment Exercises: To Assess the micro & macro environmental analysis of various firms.

Module - 2

Analyzing Consumer Behaviour: Buying motives, Factors influencing buying behaviour, Buying habits, Buying Roles, Stages in consumer buying decision process, Types of consumer buying decisions, The black box model of consumer behaviour, B2BmarketingVs.ConsumerMarketing

10 Hours (RBT Levels: L1, L2, L3, L4)

Teaching-Learning Process:

Pedagogy: Chalk & Talk Method, Group discussion, Seminar, Power point presentation, Case Study &Experiential exercises.

Skill Enrichment Exercises: Analysis of consumer behaviour traits based on miniature projects.

Module – 3

Market Segmentation, Targeting, Positioning & Branding:

Segmentation: Meaning, Factors influencing segmentation, Market Aggregation, Basis for segmentation, Segmentation of Consumer and Industrial markets. **Targeting:** Meaning , Basis for identifying target customers, Target Market Strategies, **Positioning:** Meaning, Product differentiation strategies, Tasks involved in positioning **Branding:** Concept of Branding, Brand Types, Brand equity, Branding Strategies.

10 Hours (RBT Levels: L2, L3, L4, L5)

Teaching-Learning Process:

Pedagogy: Chalk & Talk Method, Group discussion, Seminar, Power point presentation, Case Study &Experiential exercises.

Skill Enrichment Exercises: Conceptualization of STP through MS Excel.

Module – 4

Product/Service Decisions, Pricing Decisions & Marketing Channels:

Product/Service Decisions: Concept, product hierarchy, New product development, diffusion process, Product Life cycle, Product mix strategies. Packaging / Labeling: Packaging as a marketing tool, requirement of good packaging, Role of labeling in packaging. ServicesMarketing&itsCharacteristics-tasksinvolvedinservicemarketing.

Pricing Decisions: Significance of pricing, Pricing strategies, New product pricing – Price Skimming & Penetration pricing, PricingProcedure.

Market Channel: Meaning, Purpose, Channel alternatives, Factors affecting channel choice, Channel design and Channel management decisions, Channel conflict, Distribution system, Multilevel Marketing(Network Marketing)

10 Hours (RBT Levels: L2, L3, L4, L5)

Teaching-Learning Process:

Pedagogy: Chalk & Talk Method, Group discussion, Seminar, Power point presentation, Case Study &Experiential exercises.

Skill Enrichment Exercises: Practical orientation on the new product development practices followed by various firms.

Module – 5

Promotional Decisions & Strategies:

Integrated Marketing Communications: Concept of communication mix, steps in developing effective communication, Stages in designing message **Advertising:** Advertising Objectives, Advertising Budget, Advertising Copy, AIDA model **Sales Promotion:** Sales Promotion Mix, Tools and Techniques of sales promotion, Push-pull strategies of promotion. **Personal selling:** Concept, Features, Functions, Steps/process involved in Personal Selling, Publicity / **Public Relation:** Meaning, Objectives, Types, Functions of Public Relations **Direct Marketing:** Meaning, Features, Functions,

Database Marketing: Basic concepts of e-commerce, e-business, e-marketing, m-Commerce, m-marketing, e-networking, CRM, MkIS, Digital marketing communications, Traditional Vs. Modern Media- Online and Mobile Advertising.

Marketing Planning: Meaning, Steps involved in Marketing planning. Marketing Audit- Meaning, components of Marketing Audit.

10 Hours (RBT Levels: L3, L4, L5, L6)

Teaching-Learning Process:

Pedagogy: Chalk & Talk Method, Group discussion, Seminar, Power point presentation, Case Study &Experiential exercises.

Skill Enrichment Exercises: Analyze the relevant advertisements and find its effectiveness using the procedural method of DAGMAR Approach.

Course Outcomes: At the end of the course the student will be able to:

CO1: Access the business scenario and apply the fundamental concepts of marketing to aid business solutions.
CO2: Analyze various models of consumer buying behaviour for better visualization of customer traits.
CO3: Evaluating segmentation, targeting and positioning strategies to implement in business situation.
CO4: Design the implementation of commercial and distribution aspects of products and service.
CO5: Communicate the viable marketing campaign by appropriate marketing strategy.

Assessment Details

CIE :

(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to50.

1. The question paper will have 8 full questions carrying equal marks.
2. Each full question is for 20 marks.
3. Each full question will have sub question covering all the topics under a Module.
4. The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
5. 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Marketing Management-IndianContext,GlobalPerspective.	Ramaswamy &Namakumari	SAGE	6th Edition
2	MarketingManagement:ASouth AsianPerspective.	Kotler, Keller, Koshy & Jha	PearsonEducation	Latestedition
3	Marketing Management	Karunakaran	Himalayan Publication	Latest Edition
4	NewProductManagement	Merle Crawford and Anthony Di Benedetto	McGraw-Hill	LatestEditon
5	AdvertisementBrands&ConsumerBehaviour	Ramesh Kumar	SagePublications	2020
Reference Books				
1	MarketinginIndia:TextandCases	NeelameghamS	Vikas	Latestedition
2	Marketing	Lamb,Hair,McDanniel	CengageLearning	Latestedition
3	FundamentalsofMarketingManagement,	Etzel M J BJ Walker &WilliamJStanton	TataMacgrawHill	Latestedition

e-Resources:

https://www.routledge.com/Marketing-Management-Text-and-Cases/Stevens-Loudon-Wrenn/p/book/9780789002907
http://link.galegroup.com/apps/pub/8OHU/GVRL?u=ggusf_main&sid=GVRL
https://ebookcentral.proquest.com/lib/gguu-ebooks/detail.action?docID=4461937
https://www.classcentral.com/course/swayam-marketing-management-i-5308
https://www.classcentral.com/course/swayam-marketing-management-ii-12989
https://online-degree.swayam.gov.in/dyp20_d01_s2_mg10/preview

Semester:I

Course Name: Managerial Communication

Course Code	**22MBA16**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:2**	**SEE Marks**	**50**
Credits	**04**	**Exam Hours**	**03**

Pre-requisites: Students should have

- Basic Knowledge of MS-Office
- Basic Reading fluency
- Moderate Vocabulary Knowledge

Course objectives:

1. To familiarize the principles and process, barriers of communication skills
2. To impart the concepts of oral communication and presentation skills.
3. To educate the mechanics of writing and procedure to draft business letters precisely.
4. To explain the importance and uses of Business report and Methodology of business case study.
5. To aid in educating the procedures and process of managerial meeting and presentation.

Module – 1

Introduction: Meaning & Definition, Role, Classification – Purpose of communication – Communication Process – Characteristics of successful communication. Communicating within Organizations – Levels of communication, Communication flow, Communication barriers, Communication in a cross-cultural setting.

Language Skills : Introduction, four skills of language- Reading, Speaking, Writing, Listening, Importance of Language skills

9 Hours (RBT Levels: L1,L2,L3)

Teaching-Learning Process:

Pedagogy: Chalk and Talk Method,Power pointPresentation, Youtube videos, Class room activity.

Skill Enrichment Exercises: Class room activity to understand the barriers of communication, flow of communication.

Module - 2

Oral Communication: Meaning – Principles of successful oral communication, Conversation control –Reflection and Empathy: two sides of effective oral communication.

Oral Presentation: Role of business presentations, Planning and Organizing Presentation, Planning Team and Online Presentations, Developing Visual Support for Business presentation (PPT Presentation), Practicing and Delivering Presentation - Refining your delivery.

10 Hours (RBT L1, L2, L3, L4)

Teaching-Learning Process:

Pedagogy: Chalk and Talk Method,Power pointPresentation, You tube videos, Class room activity.

Skill Enrichment Exercises: Students have to prepare presentations on business topics

Module – 3

Written Communication: Purpose of writing – Clarity in writing –Principles of effective writing – Approaching the writing process systematically: The 3X3 writing process for business communication Pre writing – Writing – Revising. **Types of Written Communication in Business:** Business Letters, Employee Reviews, Recommendation Letters, Thank You Letters, Memos, proposals and Reports, Press Releases and E-mail. **11 Hours (RBT L2, L3, L4, L5)**
Teaching-Learning Process:
Pedagogy: Chalk and Talk Method,Power pointPresentation, You tube videos. **Skill Enrichment Exercises :** Drafting letters

Module – 4

Business Reports: Purpose, Kinds and Objectives of reports – Organization & Preparing reports, short and long reports Writing, writing executive summary. **Business Case Analysis:** What is a case? Characteristics of Case and its Analysis, Process of Case Analysis, Requirements of Case analysis, The structure of written casesanalysis. **10 Hours (RBT L2, L3, L4, L5)**
Teaching-Learning Process:
Pedagogy: Chalk and Talk Method,Power pointPresentation, You tube videos, Case Study Analysis in classroom. **Skill Enrichment Exercises**: Prepare the typical Business Reports and sketch the Case study analysis procedure.

Module – 5

Employment communication: Putting your best self forward, Preparing your resume, Writing covering letters and Inquiry Emails, Preparing for a Job Interview, Conducting Yourself during the Interview, Following up throughout the process, Practicing business etiquette. **Group Communication:** Meetings – Planning meetings – objectives – participants – timing – venue of meetings. **Meeting Documentation:** Notice, Agenda, and Resolution &Minutes. **10 Hours (RBT L3, L4, L5, L6)**
Teaching-Learning Process:
Pedagogy: Chalk and Talk Method,Power pointPresentation, You tube videos, Class room activity. **Skill Enrichment Exercises:** Drafting Job application and resume. Practicing interview etiquettes.

Course Outcomes:
At the end of the course the student will be able to:
CO1: To apply the communication skills for the business correspondence.
CO2: To analyze various types business presentation and adopt appropriate oral communication.
CO3: To evaluate various business letters for communication and structure the appropriate writing skills.
CO4: To draft business reports to meet the challenges of competitiveenvironment.
CO5: To develop interpersonal communication skills in varies business situation for creating business values.

Assessment Details

CIE :

(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions, selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Communicating in Business	Ober Newman	Cengage	8th Edition, 2018
2	Managerial Communication	Rai & Rai	Himalaya publishing house pvt.ltd.	2nd Edition, 2008
3	Business Communication	P D Chaturvedi MukeshChaturvedi	Pearson	3rd Edition, 2013
Reference Books				
1	Communicating in Business	Williams,Krizan Logan,Merrier	Cengage Learning	8th Edition, 2017
2	Business Communication: Process	Mary Ellen Guffey	Cengage Learning	3rd Edition, 2002
3	Business Communication	Lesikar,Flatley,Rentz ,Pande	TMH	11th Edition, 2011

e-Resources:

VTU E- learning centre	http://elearning.vtu.ac.in/
National Digital Library	https://ndl.iitkgp.ac.in/
Knowledge Academy	https://www.theknowledgeacademy.com/in/courses/communication-skills-training/

Semester: 1st

Course Name: BUSINESS ENGLISH

Course Code	**22MBA17**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:0**	**SEE Marks**	**50**
Credits	**02**	**Exam Hours**	**03**

Pre-requisites: 1. Knowledge of Basic English Grammar,
2.Basics of Computer knowledge
3. Familiar with basics of Etiquettes

Course Objectives:

1. To enable the students to become aware with presentation skills and built potential for organizing meetings.
2. To enable students for emulate the business etiquettes in business meetings and correspondence.
3. To enhance students to acquainted with body language practices.
4. To prepare students to develop the skills of leadership.
5. To comprehend students towards Interview skills.

MODULE – 1

PRESENTATION SKILLS: Introduction, Meaning, Definitions, Types of Presentation, Organizing Presentations, Presentation Preparation for Successful Presentation, Meeting Running a Meeting Opening a Meeting, controlling a Meeting, International Meetings, Evaluating of a Meeting. Excises on the choice of appropriate grammatical words **10 Hours (RBT Levels: L1, L2, L3)**
Teaching-Learning Process:
Pedagogy: Chalk & Talk method, Group discussion, Case Study, Power point presentation, Video Clippings **Skill Enrichment Exercises:**Presentation by students on selected topics and reporting.

MODULE - 2

BUSINESS ETIQUETTES: Introduction, Meaning, Definition, Types of Etiquettes, Rules of Business etiquettes Greetings, Farewells, Invitations Giving Requests, Advice, Recommendations Offers, Instructions, Orders, Apologies, Regret, Gratitude, Asking the Way, Making Accommodations in Hotels, Choosing Meals, the ABC of Table Manners, Telephoning, Making Appointments by Phone. **10- Hours (RBT Levels:L1, L2, L3, L4)**
Teaching-Learning Process:
Pedagogy: Chalk & Talk method, Group discussion, Case Study, Power point presentation. Video Clippings **Skill Enrichment Exercises:**Collect and Present the various forms of corporate business etiquettes

MODULE – 3

BODY LANGUGE: Defining Body Language, Scope and Relevance, Changing Contours, Classification,Defining Proxemics, Four Zones, Behavioral Connotations, Space and Designs, Haptics and its Role, **Behavioral Significance**: Shaking Hands and other tactile behavior. Cultural Variations, Occulesics, Right and Left Brain Associations, Different Types of Eye Contact, Individual and Group situations, Facial Expressions, Smiles and Nods, Head Tilts and Inclines Facial Expressions, Cultural Interface. **Kinesics:** Types and Contexts, Negative and Positive Gestures, Hand Movements and Steeping, Understanding Finger Movements, Fidgeting Paralanguage and Voice Modulations, Chronemics, Chromatics, Cultural and Gender Based aspects, Stereotypes, **10 Hours (RBT Levels: L1, L2, L3, L4, L5)**
Teaching-Learning Process:
Pedagogy: Chalk & Talk method, Group discussion, Case Study, Power point presentation, Video Clippings. **Skill Enrichment Exercises:**Role play on various body language gesture

MODULE – 4

GROUP DISCUSSION: Introduction, Meaning, Definition, Scope of Group discussion, objectives and purposes of Group Discussion, various phases of group discussion, participating rules in a group discussion, Group discussion tips, facilitating a group discussion. **10 Hours (RBT Levels: L3 L4, L5, L6)**
Teaching-Learning Process:
Pedagogy: Chalk & Talk method, Group discussion, Case Study, Power point presentation, Video Clippings. **Skill Enrichment Exercises:**Participation on various topics in Group discussion

MODULE – 5

INTERVIEW SKILLS: Introduction, Meaning, Definition, Types of Interviews, Basic rules of Interview, how to face interview with confidence, Basic interview etiquettes **10 Hours (RBT Levels: L3, L4, L5, L6)**
Teaching-Learning Process
Pedagogy: Chalk & Talk method, Group discussion, Case Study, Power point presentation, Video Clippings. **Skill Enrichment Exercises:**Conduct of mock interviews and role plays

Course Outcomes: **At the end of the course the students will…** CO1: Apply then skills sets of presentation and built their potentiality for organizing meetings CO2: Able to analysis business situation for behavior of business etiquettes. CO3: Apply the habits of different body languages exposure during business communication CO4: Analyze the business situation for show up leadership qualities. CO5: Ability to demonstrate the skills sets for facing Interview.

Assessment Details

CIE :

(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Elementary Market Leader	David cotton David Falveysimonkant	Pearson	3ed 2012
2	Business English	MdEifafithMd Bashir Elmagrabhi Dr fatihelelahmd Ahmed Mohamed	Alrushed book shoe edition	1st edition 2018
3	Presentation Skills for students	Journvan Emden and Lucinda Becker	Macmillan study skills	3rd 2012
Reference Books				
1	Master the Group discussion and personal interview	SheetalDesarda	Notion press	1st Edition 2015
2	The definition of body language	Allah and Barbara Pease	Alrushed book shoe edition	1st edition 2004
3	The Essential Job Interview Handbook	Journvan Emden and Lucinda Becker	Jaico Publishing House	3rd 2012

E-Resources:

https://www.coursera.org/courses?languages=en&query=business+englihttps ://www.gymglish.com/en/sh

https://www.businessenglishpod.com/

http://www.businessenglishresources.com/

Semester: II

Course Name: HUMAN RESOURCE MANAGEMENT

Course Code	**22MBA21**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:2**	**SEE Marks**	**50**
Credits	**04**	**Exam Hours**	**03**

Pre-requisites:

- Fundamentals of Management
- Basics of Accounting
- Understanding of firm, industry and sectors of economy

Course objectives:

1. To familiarize the theories and various functions of Human Resources Management
2. To teach the importance and functions of HR Planning, Acquisition and Employee Training.
3. To educate about significance of employee performance evaluation and compensation.
4. To give insight about the HR Practices for service sector units and small and medium enterprises.
5. To emphasize on the importance of innovative HR Practices

Module – 1

Human Resource Management and Personnel Management, The Importance of Human Resource Management, Models of Human Resource Management, Evolution of Human Resource Management, HRM in India, The Factors Influencing Human Resource Management , Human Resource Management and Line Managers, The HR Competencies, Human Resource Management and Firm Performance.

10 hours (RBT L1, L2, L3)

Teaching-Learning Process:

Pedagogy: Chalk and talk method, PowerPoint Presentation, Group Discussion.
Skill Enrichment Exercises: Study of HR Department in different industry

Module - 2

Human Resource Planning: Importance of HR Planning, Manpower Planning to HR Planning, Factors Affecting HR Planning, Benefits of HR Planning, HRP Process, Tools for Demand Forecasting, Attributes of an Effective HR Planning, Barriers to HR Planning, The Challenges for HR, Process of Job Analysis and Job Evaluation.
Recruitment and Selection: Importance of Recruitment, Recruitment Policies, Factors Influencing Recruitment, Recruitment Process, Sources, Evaluation of Recruitment Process, Recruitment Strategy ; Selection, Future Trends in Recruitment; Selection Process; Selection Tests; Factors Influencing Selections, Challenges in Selection, Application Tracking System using MS-Excel
Learning, Training, and Development: Training, Learning and Development, Learning Theories, The Future of Training, Learning, and Development: Crystal Gazing into the Future, World of Learning. Process of training and Techniques of Training.

12 hours (RBT L1, L2, L3, L4)

Teaching-Learning Process:

Pedagogy: Chalk and talk method, Power Point Presentation, Group Discussion, Case discussion.
Skill Enrichment Exercises: Study of different recruitment online portals

Module – 3

Performance Management and Appraisal: Objectives of Performance Management, Performance Management and Performance Appraisal, Common Problems with Performance Appraisals, Performance Management Process, Types of Performance Rating Systems, Future of Performance Management. **Compensation and Benefits** Introduction, Definitions, Total Compensation, 360 Degree appraisal, HR Mapping Total Rewards System, Forms of Pay, Theories of Compensation, External Factors, Internal Factors, Establishing Pay Rates, Employee Benefits. **10 hours (RBT L2, L3, L4, L5)**
Teaching-Learning Process:
Pedagogy: Chalk and talk method, Power Point Presentation, Case discussion. **Skill Enrichment Exercises:** Study of employee benefits offered by various business units.

Module – 4

Human Resource Management in Small and Medium Enterprises: Definition of SMEs, Human Resource Management and Performance in SMEs, The Difference in Adoption of Human Resource Management: SMEs and Large Firms, Indian Experience, Impact of Weak Adoption of Human Resource Management in SMEs, Factors Influencing the Adoption of Human Resource Management Practices in SMEs, Future of Human Resource. Management in SMEs. **Human Resource Management in the Service Sector** Introduction, The Emergence of the Services Sector, Implications for Human Resource, Management Function, Differences Between Services Sector and the Manufacturing Sector, Difference in Human Resource Management Practices in Services and Manufacturing Sectors, Human Resource Management and Service Quality Correlation, Some Specific Industries in Services Sector, Trade Unions in Services Sector, Models of Union Strategies. Case Study on "Training Program at ABC Cement". **Enterprises 10 hours (RBT L2, L3, L4, L5)**
Teaching-Learning Process:
Pedagogy: Chalk and talk method, Power Point Presentation, Group Discussion. **Skill Enrichment Exercises:** Exploratory study with an executive of an SME

Module – 5

Human Resource Management Innovations: Introduction, Employee Life cycle Management, Employee engagement, Human Resource Management and Innovations, Factors Affecting the Innovation Process in Organizations, Characteristics of Human Resource Management Innovations, Conditions Necessary for Successful HRMI Implementation, Current Trends in Human Resource Management Innovations, Innovative Human Resource Management Practices in India, How Human Resource Management Practices Contribute to Organizational Innovation, How to Make Human Resource Management Innovations Sustainable. **8 hours (RBT L3, L4, L5, L6)**
Teaching-Learning Process:
Pedagogy: Chalk and talk method, Power Point Presentation, Group Discussion, Case discussion **Skill Enrichment Exercises:** Overview of the current trends in HR Domain special attention to IT Facilitation

Course Outcomes:
At the end of the course the student will be able to:
CO1: Apply the concepts of HRM in an Organization.
CO2: Analyze the various methods of collecting data for HRP, Acquisition, and Development of Human Resource.
CO3: Evaluate the effectiveness of performance management and structure the best possible employee benefits.
CO4: Design the best possible HR Practices for service sector units and small and medium enterprises.
CO5: Construct the appropriate and innovative HR Practices for better workplace.

Practical Component:
A visit to an Organization and interact with HR Manager and list out the roles played by HR manager.
Meet Recruitment Manager and ask- 10 questions one asks during Interview.
Meet Training and Development Manager and list out various training given to employees; basis of training program; Need analysis.
Visit any Service Organization. Observe HR functions and List them.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**2**			
CO2	**2**	**3**			
CO3			**3**		
CO4				**3**	
CO5					**2**

Assessment Details

CIE:

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Human Resource Management: Theory and Practices,	R. C. Sharma, Nipun Sharma	Sage Publication India Pvt. Ltd.	2019
2	Human Resource Management: Concepts	AmitabhaSengupta	Sage Publication India Pvt. Ltd.	2019
3	Performance Management and Appraisal Systems HR Tools for Global Competitiveness	T. V. Rao	Sage Publication India Pvt. Ltd.	2004
Reference Books				
1	The HR Scorecard: Linking People, Strategy, and Performance	Brian Becker, Dave Ulrich, and Mark A. Huselid	Harvard Business School Press	2001
2	The HR Answer Book: An Indispensable Guide for Managers and Human Resources Professionals	Shawn Smith and Rebecca Mazin	AMACOM	2011
3	Managing Human Resources in Small and Medium-Sized Enterprises Entrepreneurship and the Employment Relationship	Robert Wapshott, Oliver Mallett ,	Routledge	2015
4	The HR Answer Book: An Indispensable Guide for Managers and Human Resources Professionals	Shawn Smith and Rebecca Mazin	AMACOM	2011

e-Resources:

1. **https://altametrics.com/en/human-resources-management/fundamentals-of-human-resource-management.html**
2. **https://www.economicsdiscussion.net/human-resource-management/human-resource-planning-definition-importance-objectives-process-prerequisites/31575**
3. **https://www.whatishumanresource.com/training-and-development**
4. **https://www.emerald.com/insight/content/doi/10.1108/00483480210445962/full/html**
5. **https://www.emerald.com/insight/content/doi/10.1108/IJIS-03-2020-0027/full/html**

Semester: II

Course Name: Financial Management

Course Code	**22MBA22**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**03:0:02**	**SEE Marks**	**50**
Credits	**04**	**Exam Hours**	**03**

Pre-requisites:

- Knowledge of basic concepts of financial management
- Knowledge, cost of capital, capital structure, capital budgeting etc
- Knowledge of Financial Institutions
- Knowledge of Capital markets

Course objectives:

1. To familiarize the students with basic concepts of financial management and financial system.
2. To educate the application of Cost of capital and its implications.
3. To teach investment proposals and its decisions
4. To give insights on the importance and significance of working capital in an organization.
5. To teach the capital structure theories and dividend decision theories and its implication

Module – 1

Introduction

Meaning, nature and scope of finance; financial goal - profit vs. wealth maximization; Investment, Financing and Dividend decisions - Finance functions – organization structure – functions of finance manager in 21st century – Modern role - treasurer and controller. Emerging role of finance managers. Capital Markets.

8 Hours (RBT L1, L2, L3)

Teaching-Learning Process:

Pedagogy: Chalk and talk method, PowerPoint Presentation, YouTube videos

Skill Enrichment Exercise: Study the organization structure of Nationalized Banks

Module - 2

Sources of Financing

Meaning and significance of cost of capital: Calculation of cost of debt, preference capital, equity capital and retained earnings; Combined cost of capital (weighted); Cost of equity and CAPM;

10 Hours (RBT L1, L2, L3, L4)

Teaching-Learning Process:

Pedagogy: Chalk and talk method, PowerPoint Presentation, YouTube videos

Skill Enrichment Exercise: (Case Study on Cost of Capital)

Module – 3

Investment Decisions

Capital budgeting process, Investment evaluation techniques–Net present value, Internal rate of return, Modified internal rate of return, Profitability index, Payback period, discounted payback period, accounting rateofreturnProblem).Riskanalysisincapitalbudgeting-CaseStudyonreplacementofcapitalproject.(Numerical problems). Computer lab for calculation of NPV,IRR,PI,Paybackperiod,ARRinMSexcel.

12 Hours (RBT L2, L3, L4, L5)
Teaching-Learning Process:
Pedagogy: Chalkandtalkmethod,PowerPointPresentation,YouTubevideos,MS-excel. **Skill Enrichment Exercise:** Practical orientation on the Project Evaluation (Case Study)

Module – 4

Working Capital Management Factors influencing working capital requirements-Current asset policy and current asset finance policy-**Determination of operating cycle and cash cycle on Excel**- Estimation of working capital requirements of a firm.(DoesnotincludeCash,Inventory&ReceivablesManagement). Working Capital Cycle for manufacturing Units. Financial leverage and its impact on EPEvS – Operating leverage – combined leverage – degree of leverages – working capital leverages – practical use of leverages. **10 Hours(RBT L2, L3, L4, L5)**
Teaching-Learning Process:
Pedagogy: Chalk and talk method ,PowerPointPresentation,YouTube videos,MS-excel. **Skill Enrichment Exercise:** Case study on Working Capital Determination and the impact of negative working capital Amazon-negative working capital and profitability

Module – 5

Capital structure and dividend decisions Capital structure and dividend decisions – Planning the capital structure-Governance of Equity and Debt, Fall in interest rates and perils of Debt funding. Leverages, EBIT and EPS analysis. ROI & ROE analysis. Capital structure policy. Dividend policy – Factors affecting the dividend policy - Dividend Policies- Stable Dividend, StablePayout(No dividend theories to be covered).Case Study on EBIT-EPS analysis & Leverages. **10 Hours (RBT L3, L4, L5, L6)**
Teaching-Learning Process:
Pedagogy: Chalk and talk method,PowerPointPresentation,YouTube videos, Case study discussion, MS-excel. **Skill Enrichment Exercise: Case study on Dividend Policy,MS-excel.**

Course Outcomes: At the end of the course the student will be able to: CO1: Apply the basic financial concepts of Financial management for business use CO2: Analyze the concept of cost of capital for inferential decisions CO3: Evaluate the investment decisions in changing business environment CO4: Estimate working capital requirements for business situations. CO5: Design capital structure and dividend decisions for varied industries

Assessment Details

CIE:

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

1. The question paper will have 8 full questions carrying equal marks.
2. Each full question is for 20 marks.
3. Each full question will have sub question covering all the topics under a Module.
4. The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
5. 60 percent practical and 40 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Financial Management	Khan M. Y.& Jain P. K,	TMH	7/e,
2	Financial Management	Prasanna Chandra	TMH	9/e
3	Financial Management	PrahladRathod ,BabithaThimmaiah and Harish Babu	HPH	1/e, 2015
Reference Books				
1	Financial Management	I M Pandey	Vikas Publishing	11/e 2012
2	Principles of Corporate Finance	Brealey, Myers, Allen &Mohanty	McGraw Hill Education	11/e 2014
3	Corporate Finance	Vishwanath S. R.	Sage Publications	3/e 2019

e- Resources:

1. http://egyankosh.ac.in//handle/123456789/10310
2. https://nptel.ac.in/courses/110/107/110107144/

Semester: II

Course Name: Research Methodology

Course Code	**22MBA23**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:2**	**SEE Marks**	**50**
Credits	**04**	**Exam Hours**	**03**

Pre-requisites:

Students must have the basics of Managerial process, Role of Data & Information in Research, Basics of Statistics or equivalent in order to pursue this course.

Course objectives:

1. To teach the fundamentals and importance of research methodology in business.
2. To foster insight on various research designs and techniques as base for business research.
3. To emphasize the basics of sampling methods and the use different sampling techniques.
4. To teach the methods of data collection with measurement & Scaling Techniques
5. To enable students to identify the problem and procedures for data analysis and report writing skills and presentation.

Module – 1

Introduction: Meaning, types, manager-researcher relationship, process of research-management problem, defining the research problem, formulating the research Hypothesis, developing the research proposals, research design formulation, sampling design, planning and collecting the data for research, data analysis and interpretation. Research Application in business decisions, Features of good research study, Internet and research. Ethics in Research

Skill Enrichment Exercise:

Conducting Research with teen demographics

Purpose: Purpose of this activity is to help students of Management (MBA – Research methodology) to think about the practical and ethical issues involved in conducting research with teen demographics.

7 hours (RBT L1, L2, L3)

Teaching-Learning Process:

Pedagogy: Chalk and talk, Classroom Lecturers, Seminars and Tutorials, Discussions, Power point presentations.

Module - 2

Business Research Design

Meaning and significance - Types: Exploratory and Conclusive Research Design.

Exploratory Research

Meaning, purpose, methods- Literature review process, experience survey, focus groups and comprehensive case methods. Conclusive Research Design - Descriptive Research - Meaning, Types – Cross sectional studies and longitudinal studies.

Experimental Research Design – Meaning and classification of experimental designs- formal and informal, Pre experimental design, Quasi-experimental design, True experimental design, statistical experimental design.

Skill Enrichment Exercise:

Methods for collecting, sampling, recording, storing and analyzing data.

Purpose: This activity encourages students to think about the most appropriate methods for collecting, sampling, recording, storing and analyzing data. It asks students, in their groups, to consider examples of different research projects and answer questions about each project. This will raise awareness of the variety of methods that are available. **9 hours(RBT L1, L2, L3, L4)**
Teaching-Learning Process:
Pedagogy: Chalk and talk, Classroom Lecturers, Seminars and Tutorials, Discussions, Power point presentations, Videos, Case study.

Module – 3

Concepts- Types of Sampling - Probability Sampling – simple random sampling, systematic sampling, stratified random sampling, cluster sampling -Non Probability Sampling –convenience sampling- judgmental sampling, snowball sampling- quota sampling - Sample size, Determination of Sample Size, Characteristics of a Good Sample, Errors in sampling. **Skill Enrichment Exercise:** Recognize the types of probability sampling and non probability sampling methods **Purpose:** This activity, with the use of five real-world examples, helps students to recognize the different types of probability sampling and non probability sampling methods that are available, identify possible strengths and weaknesses and think about how these different methods are used in research. **7 hours(RBT L2, L3, L4, L5)**
Teaching-Learning Process:
Pedagogy: Chalk and talk, Classroom Lecturers, Seminars and Tutorials, Discussions, Power point presentations, Research based, Case study.

Module – 4

Data Collection Primary and Secondary data Primary data collection methods - Observations, survey, Interview and Questionnaire, Qualitative Techniques of data collection, Questionnaire design – Meaning - process of designing questionnaire. Secondary data -Sources – advantages and disadvantages. **Measurement And Scaling Techniques** Basic measurement scales-Nominal scale, Ordinal scale, Interval scale, Ratio scale. Attitude measurement scale - Likert's Scale, Semantic Differential Scale, Thurstone scale, Multi-Dimensional Scaling. **Skill Enrichment Exercise:** **Identifying differences between primary and secondary sources** **Purpose:** This activity helps students to understand the differences between primary and secondary sources when they are searching for, and using, information for their course and/or their research. **Designing questionnaire** **Purpose:** This is a practical activity that helps students to design a questionnaire for their research project. It enables them to avoid common mistakes and problems with questionnaire design through providing practical tips, advice, discussion and feedback as their questionnaire is designed, developed and modified. **9 hours (RBT L3, L4, L5, L6)**

Teaching-Learning Process:

Pedagogy: Chalk and talk, Classroom Lecturers, Seminars and tutorials, Discussions, Power point presentations, videos, Case study.

Module – 5

Editing, Coding, Classification, Tabulation, Validation Analysis and Interpretation- Report writing and presentation of results: Importance of report writing, types of research report, report structure, guidelines for effective documentation.

Presentation of Statistics. Oral presentation: Aristotle's 3 Principles of Persuasive Communication. Audience analysis. Organize, Support, visualize Deliver Practice & Arrange. Research analysis by the application of SPSS software.

Skill Enrichment Exercise:
Drawing Conclusions from Qualitative Data

Purpose: This activity asks students to think about and produce a description of the process or procedure that they intend to use to draw conclusions from their qualitative data, and present their description to fellow students for peer feedback and discussion

Each student will be given a copy of the student handout. This asks them to produce a description of the process or procedure that they intend to use to draw conclusions from their qualitative data, which they must present to fellow students. **9hours (RBT L3, L4, L5, L6)**

Teaching-Learning Process:

Pedagogy: Chalk and talk, Classroom Lecturers, Seminars and Tutorials, Discussions, Power point presentations, Case study.

Course Outcomes:

At the end of the course the student will be able to:

CO 1: Ability to apply the methods and research techniques to business and management issues.
CO 2: Analyze the appropriate research design, techniques and strategies in the research process.
CO 3: To Evaluate the different methods of sampling of empirical information for better inferences.
CO 4: To Design various research data collection methods by measurement & scaling techniques for quantitative data analysis.
CO 5: To communicate the effective reporting of the business to aid in managerial decisions.

Assessment Details

CIE :

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full questions from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Business Research Methods	Zikmund, Babin, Carr, Adhikari and Griffin	Cengage Learning	8th Edition, 2016
2	Research Methodology, Concepts and Cases,	Deepak Chawla and NeenaSondhi	Vikas publishing house pvt.ltd.	2nd Edition, 2016.
3	Research Methodology,	C R Kothari	New Age International,	4th Edition, 2019.
4	Marketing Research: Text and Cases,	RajendraNargund kar	Mcgraw Hill Education,	4th Edition, 2019.
Reference Books				
1	Research Methods	William M C, Trochim	Biztantra	2nd Edition, 2004
2	Methodology Of Research In Social Sciences	MRanganatham, O R Krishnaswamy	Himalaya Publishers	3rd Edition, 2016
3	Research Methodology	Panneerselvam R	PHI Learning,	2nd Edition, 2014.
4	Statistical Methods for Practice and Research A guide to data Analysis using SPSS	Ajai S. Gaur and SanjayaS.Gaur	Response Books	2nd Edition, 2009

E-Resources:

1. **https://onlinecourses.nptel.ac.in/noc22_ge08/preview**
2. **https://nptel.ac.in/courses/121/106/121106007/**
3. **https://www.youtube.com/watch?v=XEMyDu_VoeQ**
4. **https://www.emeraldinsight.com/**
5. **https://www.proquest.com/165290**
6. **https://www.bitm.knimbus.com**

Semester: II

Course Name: COMPUTER APPLICATION IN MANAGEMENT

Course Code	**22MBA24**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:2**	**SEE Marks**	**50**
Credits	**4**	**Exam Hours**	**03**

Pre-requisites: Familiar with the MS word, Basic knowledge with MS Excel, Basic logical and analytical knowledge, basic mathematic knowledge.

Course Objectives

1. To contemplate the Computer Concepts and applicable in field of Management.
2. To Analyze the excel functions as a tool for decision making in business situations.
3. To Evaluate data by use of MS Access for managerial decision making
4. To share Insights the concept of e-commerce using web technologies
5. To explain the concept of IOT and Business Analytics

Module – 1

Introduction to Computer: Introduction, Information and Data, Importance of Hardware and software, CPU, Primary and Secondary storage, I/O devices, Bus structure, Computer Peripherals-VDU, Keyboard, Mouse, Printer. Software and Types of Software, Operation system and types, Programming Languages-, High Level Language. **9 Hours (RBT Levels:L1, L2, L3)**

Teaching-Learning Process:

Pedagogy: Chalk and talk, Power point presentation, Group discussion, videos clippings, Demonstration of Hardware component of computer.

Skill Enhancement Activities: Lab session Demonstrations and Videos clippings, Presentation of Hard ware components

Module - 2

Introduction to Excel:Spreadsheet Concepts, Creating, Saving and Editing a Workbook, Inserting, Deleting Work Sheets, entering data in a cell / formula Copying and Moving from selected cells, basic statement; SUM, AUTOSUM, SUMPRODUCT, AVG, IF, COUNTIF.

Formatting a Worksheet: Formatting Cells – changing data alignment, changing date, number, character or currency format, changing font, adding borders and colors, Printing worksheets, Charts and Graphs – Creating, Previewing, Modifying Charts.

Functions: Mathematical, Logical, statistical, text, financial, Date and Time functions, Using Function Wizard.**10Hours (RBT Levels L1, L2, L3, L4)**

Teaching-Learning Process:

Pedagogy: Chalk and talk, Group discussion, Case Study, Power point presentation, videos clippings, Exercises conducted in computer lab

Skill Enhancement Activities: Lab session of excel function and formula, Solving practical business Problems.

Module – 3

Introduction to DBMS: Database Management System & Applications Overview of Database Management – File oriented approach versus database oriented approach to data management, Disadvantage of file oriented approach

MS-Access: Introduction, creation of database and table, inserting values in a table, Sorting, deletion, Merging of rows, Linking on table and another, Report generation, Embedding MS excel in Access.**11 Hours (RBT Levels: L2, L3, L4, L5)**

Teaching-Learning Process:
Pedagogy: Chalk and talk, Group discussion, Case Study, Power point presentation, Exercises conducted in computer lab, videos clippings **Skill Enhancement Activities:** Lab session of MS Access Solving practical business Problems.

Module – 4

Introduction to Internet and Web Technologies: Definition, application, threats, working of Internet, Web Technology: Introduction, Types of servers, cryptocurrency conceptse-Commerce: Structure of e-commerce, Types of e-Commerce, analytics of e-commerce,ethics of E-commerce **10 Hours (RBT Levels:L2, L3, L4, L5)**
Teaching-Learning Process:
Pedagogy: Chalk and talk, Group discussion, Case Study, Power point presentation, videos clippings **Skill Enhancement Activities:** Basics Theoretical exercise on e-commerce and its application

Module – 5

Introduction to IOT and Business Analytics : Overview of IOT; meaning of IOT; History of IOT; Advantages of IOT; Challenges of IOT; IOT working process; Architecture of IOT; Devices and network; Applications of IOT at Smart home. Overview for Data Science; Definition of data and information; Data types and representation; Data Value Chain; Data Acquisition; Data Analysis; Data Curating; Data Storage; Data Usage; Basic concepts of Big Data.**10Hours (RBT Levels: L3, L4, L5, L6)**
Teaching-Learning Process:
Pedagogy: Chalk and talk, Group discussion, Case Study, Power point presentation, videos clippings **Skill Enhancement Activities:** Basics Theoretical exercise on IOT its application

Course outcomes: At the end of the course the student will be able to: CO1: To apply the basis of computer application for visualization of data to aid decisions CO2: To analysis and interpret the data for interpretation business situation CO3: To evaluate the different business scenarios with the DBMS Concept CO4: To Demonstrate the data structuring and constructing the business Models CO5: To Comprehend the latest developments in the area of technology to support business

Assessment Details

CIE :

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be

proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full questions from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Designing for Emerging Technologies: UX for Genomics, Robotics, and the Internet of Things	Follett, J.	O'Reilly Media	2014
2	Emerging Technologies for Emerging Markets	Vong, J., & Song, I.	Springer Singapore	2014
3	Teach Yourself Excel	Matthew Harris	SAM	1999 ISB-13: 978-0672315435
4	MS Access Programming by Example	JulittaKorol	Wordware Publishing Inc.	2001
5	A Textbook on E-Commerce: Text & Cases	W. K. Sarwade&AnuranjanMisra	A.K. Publications	ISBN-10: 9380164270
Reference Books				
1	Winning in the Digital Age: Seven Building Blocks of a Successful Digital Transformation .	by Nitin Seth	Penguin Enterprise	24 February 2021
2	Computer Applications in Management	PuneetSaneja Charu Chawla	Hindustan Publishing Corporation ISBN: 9788124116937, 9788124116937	2019

e-Resources:

1. https://www.ddegjust.ac.in/studymaterial/mba/cp-106.pdf
2. https://lumenlearning.com/courses/computer-applications-for-managers/
3. https://www.encyclopedia.com/computing/news-wires-white-papers-and-books/library-applications

Semester: II

Course Name: Strategic Management

Course Code	**22MBA25**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:2**	**SEE Marks**	**50**
Credits	**04**	**Exam Hours**	**03**

Pre-requisites: Students should have basic knowledge of

- Management and Organizational Behaviour Principles
- Basic economic terminologies and concepts.
- Basic Finance fundamentals.
- Logical Reasoning

Course objectives:

1. To provide insights on applications of core concepts and models of strategic management.
2. To emphasize various business models in dynamic market environments.
3. To infer insights about various strategic management models used in different business phases.
4. To educate the importance of overview of business and formulating and implementation of strategies.
5. To teach the importance of strategic controlling measures for better decision making.

Module – 1

Introduction: Meaning and Nature of Strategic Management, its Importance and Relevance and. Characteristics of Strategic Management, The Strategic Management Process. Relationship Between a Company's Strategy and its Business Model. **Skill Enrichment Exercise:** Study of strategic overview of companies across industries. **Strategy Formulation:** Developing Strategic Vision and Mission for a company – Setting Objectives – Strategic Objectives and Financial Objectives – Goals, Long Term Objectives, Short-Term Objectives, Strategic group mapping, Strategic Intent, Strategic Fit, Gap Analysis, Balanced Scorecard **10 Hours (RBT Levels: L1, L2, L3)**
Teaching-Learning Process:
Pedagogy: Chalk & Talk Method, Group discussion, Seminar, Power point presentation, Case Study &Experiential exercises. **Skill Enrichment Exercises:** Applications of balanced scorecard in an organization.

Module - 2

Analyzing Companies External Environment: **External Analysis:** StrategicallyRelevantComponentsofaCompany'sExternalEnvironment– IndustryAnalysis-FactorsDrivingIndustry Change and its Impact - Porter's Dominant Economic Feature - Competitive Environment Analysis - Porter's Five Forces Model– Key Success Factors Concept and Implementation. **10 Hours (RBT Levels: L1, L2, L3, L4)**
Teaching-Learning Process:
Pedagogy: Chalk & Talk Method, Group discussion, Seminar, Power point presentation, Case Study &Experiential exercises. **Skill Enrichment Exercises:** Assignments for Assessing the critical success factors by appropriate models.

Module – 3

Analyzing Companies Internal Environment:
Internal Analysis: Analyzing a company's resources and competitive position – Analysis of a Company's present strategies - SWOT Analysis – Resource Based View of the firm (RBV) - Value Chain Analysis – Benchmarking, Generic Competitive Strategic – Low cost provider Strategy - Differentiation Strategy - Best cost provider Strategy – Focused Strategy – Growth strategies & retrenchment strategies - Strategic Alliance and Collaborative Partnerships – Mergers and Acquisition Strategic - Outsourcing Strategic - International Business level.

10 Hours (RBT Levels: L2, L3, L4, L5)

Teaching-Learning Process:

Pedagogy: Chalk & Talk Method, Group discussion, Seminar, Power point presentation, Case Study &Experiential exercises.
Skill Enrichment Exercises: SWOT analysis on various organizations with strategic intent.

Module – 4

Business planning in different environment:
Business planning in different environment - Entrepreneurial level Business planning – Multistage wealth creation model for entrepreneurs – Planning for large and diversified companies – brief overview of Innovation, integration, Diversification, Turnaround Strategic – GE nine cell planning gird – BCG matrix.

10 Hours (RBT Levels: L2, L3, L4, L5)

Teaching-Learning Process:

Pedagogy: Chalk & Talk Method, Group discussion, Seminar, Power point presentation, Case Study &Experiential exercises.
Skill Enrichment Exercises: Contemplating various strategic models across industries.

Module – 5

Strategic Implementation & Control:
Organizational design, structures, culture, Importance of integrating strategy implementation and strategy formulation. Organizational structures used to implement different business level strategies and corporate level strategy. Strategic control, Types, Role of Corporate Governance.

10 Hours (RBT Levels: L3, L4, L5, L6)

Teaching-Learning Process:

Pedagogy: Chalk & Talk Method, Group discussion, Seminar, Power point presentation, Case Study &Experiential exercises.
Skill Enrichment Exercises: Case studies on Corporate governance practices of varied organizations.

Course Outcomes:

At the end of the course the student will be able to:
CO1: Apply concepts and models of strategic management.
CO2: Analysis the business environment to formulating appropriate strategy for business development.
CO3: Evaluate the competitive situation using strategic models in dealing with business environment.
CO4: Develop the driving strategies for the holistic business challenges in varied industries.
CO5: Design strategic performance using controlling measures for business situations.

Assessment Details

CIE :

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Crafting and Executing Strategy:The Quest for CompetitiveAdvantage–ConceptsandCases	ArthurA.ThompsonJr.Margaret A. PeterafJohnE. Gamble A.J.StricklandIIIArunK. Jain	McGraw HillEducation	19/e 2017
2	StrategicManagement: ASouth-AsianPerspective	MichaelA.Hitt R. Duane IrelandRobertE.Hoskisson S.Manikutty	CengageLearning	9/e 2016
Reference Books				
1	Strategy: Theory&Practice	StewartCleggChris CarterMarting KornbergerJochenSchweitzer	SagePublications	3/e,2020
2	Strategy Management:Theory&Practice	JohnParnell	Biztantra	2004
3	StrategicManagement: Planning for Domestic and GlobalCompetition	John A. PearceRichardB.Robinson	McGraw HillEducation	14/e 2015

e-Resources:

https://youtu.be/ZG3_8fG7RzQ[BBC Documentary]-Worlds Most Powerful- - Bill Gates Vs Steve Jobs
https://youtu.be/0FoTFal0KAA - BBC Documentary_ Steve Jobs - Billion Dollar Hippy
https://youtu.be/5WiDIhIkPoM - Mark Zukerberg_ Inside Facebook (BBC)
https://youtu.be/y5I_cnpP99U - Michael Porter on Competitiveness
https://youtu.be/xcZG5sIqSHE
https://www.classcentral.com/course/swayam-strategic-management-14306
https://onlinecourses.swayam2.ac.in/imb20_mg33/preview
https://swayam.gov.in/nc_details/IIMB
https://nptel.ac.in/courses/110/108/110108047/

Semester: II

Course Name: ENTREPRENEURSHIP & LEGAL ASPECTS

Course Code	**22MBA26**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:2**	**SEE Marks**	**50**
Credits	**04**	**Exam Hours**	**03**

Pre-requisites:

- Basic Fundamentals of Marketing, HR, Finance & Accounting skills inclination to innovation
- Good communication & presentation skills
- Inquisitiveness for entrepreneurship
- Knowledge about business environment

Course objectives:

1. To educate the nature, characteristics and importance of entrepreneur.
2. To impart planning insights and preparation feasibility business reports.
3. To provide an overview of entrepreneurship opportunities, sources of funding and institutions supporting entrepreneurs.
4. To familiarize the concept family business performance, and strategies for its development.
5. To emphasize the various rules and legislations related to various acts for entrepreneurial development.

Module – 1

Entrepreneur & Entrepreneurship: Meaning of entrepreneur - Evolution of the concept - Functions of an Entrepreneur - Classification of Entrepreneur – Role of an Entrepreneur- Intrapreneur- an emerging class – Concept - Entrepreneur Vs Intrapreneur Vs Manager - Evolution and Development of Entrepreneurship - Entrepreneurial mindset and process. **Creativity and Innovation:** The role of creativity- The innovation Process -Sources & Methods of Generating New Ideas & Creative Problem Solving. **(10 hours) (RBT Levels: L1, L2, L3)**
Teaching-Learning Process:
Pedagogy: Chalk and Talk method, Group Discussion, Case Study, Power Point Presentation, Video clipping **Skill Enrichment Exercises:** Students should submit a profile summary of a successful local entrepreneur indicating milestone achievements.

Module - 2

Business Planning Process: Importance of Business Model- Components of an Effective Business Model, Osterwalder Business Model Canvas. Meaning of business plan - Business plan process - Advantages of business planning – Why do Business plans fail - Marketing plan - Production/operations plan - Organization plan – Financial plan - Final Project Report with Feasibility Study - preparing a model project report for starting a new venture. **(10 hours) (RBT Levels: L1, L2, L3, L4)**
Teaching-Learning Process:
Pedagogy: Chalk and Talk Method, Group Discussion, Case Study, Power Point Presentation **Skill Enrichment Exercises:** Students should develop a business model for a new product/service including feasibility report.

Module – 3

Entrepreneurial finance: Estimating the financial needs of a new venture, internal & external sources of finance **Informal Risk Capital and Venture Capital:** Informal risk capital market - venture capital – nature, overview and process – professionals involved in venture capital – venture capital industry in India. **Institutions supporting Entrepreneurs:** Small industry financing developing countries – A brief overview of financial institutions in India - Central level and state level institutions – SIDBI- NABARD - IDBI - SIDCO - Indian Institute of Entrepreneurship - DIC – Single Window - Latest Industrial Policy of Government of India. **(10 hours) (RBT Levels: L2, L3, L4, L5)**
Teaching-Learning Process:
Pedagogy: Chalk and Talk Method, Group Discussion, Case Study, Power Point Presentation, Video clipping **Skill Enrichment Exercises:** Students should visit a bank/financial institution to enquire about various funding schemes for small scale enterprise. Student engagement in Karnataka Udyog web sites https://www.india.gov.in/karnataka-udyog-mitra-portal

Module – 4

Family Business: Importance of family business – Types- Various Forms of business organization - History - Responsibilities and rights of shareholders of a family business – 3-circle model of family business -Succession in family business - Pitfalls of the family business - strategies for improving the capability of family business - improving family business performance. Success stories of entrepreneurial knowledge exercises. **Startup Business**: Startup Process, and its feasibility **(10 hours) (RBT Levels: L2, L3, L4, L5)**
Teaching-Learning Process:
Pedagogy: Chalk and Talk Method, Group Discussion, Case Study, Power Point Presentation, Video clipping **Skill Enrichment Exercises**: Students should analyze the performance of listed family firms and should submit a short report by studying the ideology and working of partnership firm, cooperative society, private and public company. Case study related to performance of family business.

Module – 5

Applicability of Legislation; Industries Development (Regulations) Act, 1951; Factories Act, 1948; Industrial Employment (Standing Orders) Act, 1946, Suspension, Stoppage of work, Termination of employment; Karnataka Shops and Establishment Act, 1961; Environment (Protection) Act, 1986; The sale of Goods Act; 1930; Industrial Dispute Act 1947. **(10 hours) (RBT Levels: L3, L4, L5, L6)**
Teaching-Learning Process:
Pedagogy: Chalk and Talk Method, Group Discussion, Case Study, Power Point Presentation, Video clipping **Skill Enrichment Exercises:** Students should submit report by assessing the applicability of various acts by selecting different companies. Case study related to Factories Act 1948.

Course Outcomes: CO1: Apply the concept of entrepreneurship to various business plans. CO2: Analyze the feasibility of different stages in business planning process.

CO3: Evaluate the various sources of funding to support entrepreneurship.
CO4: Develop the key elements of entrepreneurship in relation to family business organizations.
CO5: Comprehend the various rules, legislations and their applicability in entrepreneurial development.

Assessment Details

CIE :

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions, selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	The Dynamics of Entrepreneurial Development and Management	Vasant Desai	Himalaya Publishing House	6th Edition 2019
2	Entrepreneurship Development-Small Business Enterprises	Poornima Charantimath	Pearson Education	3rd Edition 2015
3	Entrepreneurship	Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd	McGrawHill	6th Edition 2008
Reference Books				
1	Entrepreneurial Development	Dr. S. S. Khanka	S. Chand Publishing House	Revised Edition - 2007
2	Entrepreneurship	Rajeev Roy	Oxford University Press	3rd Edition.

e-Resources:

1. https://www.youtube.com/watch?v=Bf_nEWxSSkQ
2. https://www.youtube.com/watch?v=sOjeQV5pHh4
3. https://www.youtube.com/watch?v=Fqch5OrUPvA
4. https://www.youtube.com/watch?v=sC236knTsYw
5. https://www.youtube.com/watch?v=YlQFRzW6USQ

Semester: II

Course Name: BUSINESS ETHICS AND HUMAN VALUES

Course Code	**22MBA27**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:0**	**SEE Marks**	**50**
Credits	**02**	**Exam Hours**	**03**

Pre-requisites: Familiar with the basic management concepts and human Relation and Finance concepts, familiar with basics concepts of corporate social responsibility (CSR).

Course objectives:

1. To familiarize the business Ethics and to provide best practices of business situation.
2. To learn the values and ethical issues in corporate governance and to adhere to the ethical codes.
3. To teach the work ethos and values required for good managers and ethical careers.
4. To educate the significance of stress management and mechanism to handle employee stress.
5. To give insights on the contemporary Indian ethos in work environment.

Module – 1

Introduction: Values-Concept, types and formation of values, ethics, values and behaviour, Values of Indian Managers, Ethics, development of ethics, ethical decision making and decision making process, relevance of ethics and values in business.

8 Hours (RBT Levels: L1, L2, L3)

Teaching-Learning Process:

Pedagogy: Chalk & Talk method, Group discussion, Case study, Power point presentation, Video Clippings, Quiz

Skill Enrichment Exercise: Learn the principal of ethic by corporate example

Module - 2

Corporate Social Responsibility & Consumer Protection:

Corporate Social Responsibility & Consumer Protection: Corporate responsibility of business: employees, consumers and community, Corporate Governance, Code of Corporate Governance, Consumerism, unethical issues, in sales, marketing and technology.

10Hours (RBT Levels: L1, L2, L3, L4)

Teaching-Learning Process:

Pedagogy: Chalk & Talk method, Group discussion, Case study, Power point presentation, Video Clippings, Quiz

Skill Enrichment Exercise: Collect the Data of various companies involved in CSR activities.

Module – 3

Work Ethos and Values: Work Ethos: Meaning, Levels, Dimensions, Steps, Factors Responsible for Poor Work Ethos. Values: Meaning, Features, Values for Indian Managers, Relevance of Value Based Management in Global Change, Impact of Values on Stakeholders: Employees, Customers, Government, Competitors and Society. Relevance of values in management: need for values in global change- Indian perspective; values for managers; holistic approach for managers in decision making; secular versus spiritual values in management, Trans-Cultural Human Values in Management and Management Education, Importance of Value System in Work Culture, teaching ethics,Concept of Value Champions.

12 Hours (RBT Levels: L2, L3, L4, L5)

Teaching-Learning Process:

Pedagogy: Chalk & Talk method, Group discussion, Case study, Power point presentation, Video Clippings, Quiz.

Skill Enrichment Exercise: Case Study on Work Ethos and Values.

Module – 4

Stress Management: Meaning, Types of Stress at Work, Causes of Stress, Consequences of Stress, Problems relating to stress in corporate management –Indian perspective, Stress Management Techniques: Meditation-Meaning, Techniques, Advantages, Mental Health and its Importance in Management, Brain Storming, Brain Stilling, Yoga: Meaning, Significance. **10 Hours (RBT Levels: L2, L3, L4, L5)**
Teaching-Learning Process:
Pedagogy: Chalk & Talk method, Group discussion, Case study, Power point presentation, Debate,Quiz **Skill Enrichment Exercise:** Role plays on handling stress Management.

Module – 5

Leadership: Meaning, Contemporary Approaches to Leadership, Joint Hindu FamilyBusiness–LeadershipQualitiesofKarta;Motivation:Meaning,IndianApproachto Motivation,Techniques.Self-Management:PersonalgrowthandLessonsfromAncient Indian Education System, Personality Development: Meaning, Determinants,Indian Ethos and Personality Development, science and human values. Trans-cultural human values in management education. **10 Hours (RBT Levels: L3, L4, L5, L6)**
Teaching-Learning Process:
Pedagogy: Black Board Teaching, Group discussion, Case study, Power point presentation, Debate,Quiz **Skill Enrichment Exercise:** Role Plays of various leadership styles.

Course Outcomes:
CO1: Illustrate and apply the theoretical foundations of business ethics.
CO2: Analyze the knowledge of corporate governance and business concepts from an ethical perspective.
CO3: Evaluate the importance of Work Ethos and Values of business with community and ethical conduct.
CO4: Develop proactive steps to stressful business situations and resolve ethical.
CO5: Communicate and reflect by critically examine the values and importance of the ethical dimension in business and workplace decision making.

Assessment Details

CIE :

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be

proportionately reduced to 50.

1. The question paper will have 8 full questions carrying equal marks.
2. Each full question is for 20 marks.
3. Each full question will have sub question covering all the topics under a Module.
4. The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
5. 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Foundation of Managerial Work-Contributions from Indian Thought	Chakraborty, S.K	Himalaya Publication House, Delhi	1998
2	Ethics In Management and Indian Ethos	Biswanath Ghosh	Vikas Publishing House	2009
3	Indian Ethos and Values for Managers	Khandelwal	Himalaya Publication House, Delhi	2009
Reference Books				
1	Indian Ethics and Values in Management	R Nandagopal, AjithSankar R. N.	Tata Mc Graw Hill	2009
2	Management by Values	S. K. Chakraborty	Oxford University Press, New Delhi	2009
3	Ethics and the Conduct of Business	by R Boatright John D Smith Jeffrey PrasanPatra Bibhu	Pearson Education	Oct 2017

e-Resources:

1. https://soaneemrana.org/onewebmedia/Professional%20Ethics%20and%20Human%20Values%20by%20R.S%20NAAGARAZAN.pdf
2. https://www.researchgate.net/publication/226607374_Business_Ethics_Resources_on_the_Internet
3. https://soaneemrana.org/onewebmedia/Professional%20Ethics%20and%20Human%20Values%20by%20R.S%20NAAGARAZAN.pdf

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT
Autonomous Institute under Visvesvaraya Technological University, Belagavi

"JnanaGangotri" Campus, #873/2, Ballari-Hosapete Road, Near Allipura, Ballari-583 104 (Karnataka)

III Semester

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT - BALLARI
3rd Semester Scheme (Course with Dual Specialization)
(Effective from the academic year 2021-22)
Data Analytics Specialization

SN	Course Code	Course Name	Teaching hours per week			Marks for		Total Marks	Credits
			Lecture	Practical component	Total	CIE	SEE		
1	21MBADA301	Data Analytics For Managers	2	2	4	50	50	100	3
2	21MBADA302	DataBase Management System	2	2	4	50	50	100	3
3	21MBADA303	Python Programming For Managers	2	2	4	50	50	100	3
4	21MBADA304	Data Warehousing	2	2	4	50	50	100	3
5	21MBADA305	Decision Support System	2	2	4	50	50	100	3
6	21MBADA306	Digital Transformation	2	2	4	50	50	100	3
7	21MBAIN307	Internship	0	8	8	50	50	100	4
8	21MBAAT308	Business Aptitude (Mandatory Non – Credit Course)	2	2	4	100	-	100	-
		Total	14	22	36	450	350	800	22

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT - BALLARI
3rd Semester Scheme (Course with Dual Specialization)
(Effective from the academic year 2021-22)
Logistics & Supply Chain Management Specialization

SN	Course Code	Course Name	Teaching hours per week			Marks for		Total Marks	Credits
			Lecture	Practical component	Total	CIE	SEE		
1	21MBALS301	Basics of Logistics and Supply ChainManagement	2	2	4	50	50	100	3
2	21MBALS302	Warehouse Management	2	2	4	50	50	100	3
3	21MBALS303	Purchasing and Strategic Sourcing	2	2	4	50	50	100	3
4	21MBALS304	Inventory Management	2	2	4	50	50	100	3
5	21MBALS305	Supply Chain Management and Risk Modeling	2	2	4	50	50	100	3
6	21MBALS306	E-Logistics	2	2	4	50	50	100	3
7	21MBAIN307	Internship	0	8	8	50	50	100	4
8	21MBAAT308	Business Aptitude (Mandatory Non – Credit Course)	2	2	4	100	-	100	-
		Total	14	22	36	450	350	800	22

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT - BALLARI 3rd Semester Scheme (Course with Dual Specialization) (Effective from the academic year 2021-22) Finance Specialization									
SN	Course Code	Course Name	Teaching hours per week			Marks for		Total Marks	Credits
			Lecture	Practical component	Total	CIE	SEE		
1	21MBAFM301	Financial Markets and Services	2	2	4	50	50	100	3
2	21MBAFM302	Investment Management	2	2	4	50	50	100	3
3	21MBAFM303	Direct Taxation	2	2	4	50	50	100	3
4	21MBAFM304	Advanced Financial Management	2	2	4	50	50	100	3
5	21MBAFM305	Mergers & Acquisition and Business Valuation	2	2	4	50	50	100	3
6	21MBAFM306	Financial Modeling	2	2	4	50	50	100	3
7	21MBAIN307	Internship	0	8	8	50	50	100	4
8	21MBAAT308	Business Aptitude (Mandatory Non – Credit Course)	2	2	4	100	-	100	-
		Total	14	22	36	450	350	800	22

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT - BALLARI 3rd Semester Scheme (Course with Dual Specialization) (Effective from the academic year 2021-22) Marketing Specialization									
SN	Course Code	Course Name	Teaching hours per week			Marks for		Total Marks	Credits
			Lecture	Practical component	Total	CIE	SEE		
1	21MBAMM301	Behavioural Marketing	2	2	4	50	50	100	3
2	21MBAMM302	Advanced Retail Management	2	2	4	50	50	100	3
3	21MBAMM303	Services Marketing	2	2	4	50	50	100	3
4	21MBAMM304	Marketing Research and Analytics	2	2	4	50	50	100	3
5	21MBAMM305	Business Marketing	2	2	4	50	50	100	3
6	21MBAMM306	Tourism Marketing	2	2	4	50	50	100	3
7	21MBAIN307	Internship	0	8	8	50	50	100	4
8	21MBAAT308	Business Aptitude (Mandatory Non – Credit Course)	2	2	4	100	-	100	-
		Total	14	22	36	450	350	800	22

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT - BALLARI 3rd Semester Scheme (Course with Dual Specialization) (Effective from the academic year 2021-22) Human Resource Specialization									
SN	Course Code	Course Name	Teaching hours per week			Marks for		Total Marks	Credits
			Lecture	Practical component	Total	CIE	SEE		
1	21MBAHR301	Talent Acquisition	2	2	4	50	50	100	3
2	21MBAHR302	Human Resource Analytics	2	2	4	50	50	100	3
3	21MBAHR303	Organizational Change Management	2	2	4	50	50	100	3
4	21MBAHR304	Learning And Development	2	2	4	50	50	100	3
5	21MBAHR305	Employee Relations & Labour Laws	2	2	4	50	50	100	3
6	21MBAHR306	Human Resource Audit	2	2	4	50	50	100	3
7	21MBAIN307	Internship	0	8	8	50	50	100	4
8	21MBAAT308	Business Aptitude (Mandatory Non – Credit Course)	2	2	4	100	-	100	-
		Total	14	22	36	450	350	800	22

Semester: III

Course Name: Data Analytics For Managers

Course Code	**21MBADA301**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**

Module – 1 Wholeness of Data Analytics 8 Hours

Introduction, Business Intelligence, Pattern Recognition, Data Processing Chain. Business Intelligence Concepts and Applications: Introduction, BI for better decisions, decision types, BI tools, BI skills, BI applications.
Teaching-Learning Process:
Pedagogy: Lab and Lecture method.

Module –2 Online Transaction Processing and Data Warehouse 8 Hours

Structure, objectives, introduction, online transaction processing, OLTP system characteristics, OLTP merits and demerits, need of data warehouse, characteristics of DW, main components of data warehouse, approaches for constructing a data warehouse, dimensional modeling used in DW design-facts, dimensions and attributes, types of schemas, ETI and other tools sets available in market.
Teaching-Learning Process:
Pedagogy: Lab and Lecture method.

Module – 3 Business Intelligence And Its Deeper Dynamics 8 Hours

Structure, objectives, business intelligence, BI characteristics, data quality: a real challenge, data quality best practices, structured versus unstructured, differences between structured and unstructured data, data lake, data lake versus data warehouse, main components of a data lake, modern business intelligence system, benefits and use cases of modern BI.
Teaching-Learning Process:
Pedagogy: Lab and Lecture method.

Module – 4 Introduction to Data Visualization 8 Hours

Structure, objectives, presenting data visualization, aims of data visualization, history at a glance, importance of data visualization, types of data visualization-hierarchical, tree diagram, tree map, ring chart, dendogram, temporal, bar chart, line graph, stacked graph, Gantt chart, scatter plot, stacked area chart, sparkline, network, word cloud, matrix chart, node link diagram, multi-dimensional, pie chart, histogram.
Teaching-Learning Process:
Pedagogy: Lab and Lecture method.

Module – 5 Decision Tree 8 Hours

Introduction, decision tree problem, decision tree construction, decision tree algorithms. **Advanced data visualization**- structure, objective, types of advanced data visualization-bubble chart, word cloud, geospatial heat map/ hot spot mapping, data visualization trends, introducing data visualization tools, data visualization best practices.
Teaching-Learning Process:
Pedagogy: Lab and Lecture method.

Course Outcomes: At the end of the course the student will be able to:
CO1: Apply the BI concepts to solve business problems.
CO2: Apply the OLTP techniques to provide business solutions
CO3: Apply BI techniques to create data lake.
CO4: Analyse data using various data visualization techniques.
CO5: Analyse trends using advanced data visualization techniques.

Assessment Details

Continuous Internal Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Data Analytics	Anil Maheshwari	Mc Graw Hill Education	2018
2	A General Introduction to Data Analytics	João Mendes Moreira, André C. P. L. F. de Carvalho, Tomáš Horváth	Wiley and Sons Inc.	1st Edition, 2019

Semester: III

Course Name: Data Base Management System (DBMS)

Course Code	**21MBADA302**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**

Module – 1 Introduction to Databases 8 Hours

Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications. Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment. Conceptual Data Modelling using Entities and Relationships: Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, examples.
Teaching-Learning Process:
Pedagogy: Lab and Lecture method.

Module –2 Relational Model 8 Hours

Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations **Design:** Relational Database Design using ER-to-Relational mapping. **SQL:** SQL data definition and data types, specifying constraints in SQL, retrieval/queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL.
Teaching-Learning Process:
Pedagogy: Lab and Lecture method.

Module – 3 SQL: Advances Queries 8 Hours

More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL. **Database Application Development:** Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures.
Teaching-Learning Process:
Pedagogy: Lab and Lecture method.

Module – 4 Normalization: Database Design Theory 8 Hours

Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form.
Teaching-Learning Process:
Pedagogy: Lab and Lecture method.

Module – 5 Transaction Processing 8 Hours

Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL. **Concurrency Control in Databases:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking.
Teaching-Learning Process:
Pedagogy: Lab and Lecture method.

Course Outcomes: At the end of the course the student will be able to:
CO1: Identify and define database objects using RDBMS tools.
CO2: Design database to solve business problems
CO3: Apply normalization techniques to normalize the database.
CO4: Apply normalization techniques to design the database to solve business problems
CO5: Demonstrate the use of concurrency and transaction in database.

Assessment Details

Continuous Internal Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
		Textbooks		
1	Fundamentals of Database Systems	RamezElmasri and Shamkant B. Navathe	Pearson..	7th Edition, 2017,
2	Database management systems	Ramakrishnan and Gehrke	McGraw Hill	3rd Edition, 2014

3				
Reference Books				
1	Database System Concepts	SilberschatzKorth and Sudharshan	McGraw Hill	6th Edition, Mc-GrawHill, 2013.
2	Database Principles Fundamentals of Design, Implementation and Management	Coronel, Morris, and Rob	Cengage Learning	2012

Semester: III

Course Name: Python Programming for Managers

Course Code	**21MBADA303**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total hours of Pedagogy	**40**	**Total Marks**	**100**

Module – 1 Classification & Prediction 8 Hours

Decision tree learning, Naïve Bayes Classifier, Text classification & Artificial Neural Network. Evaluation of models.
Clustering: K-means & K-medoids clustering, DBSCAN, Agglomerative Hierarchical Clustering, BIRCH, cluster evaluation.

Teaching-Learning Process:

Pedagogy: Lab and Lecture method.

Module – 2 Introduction to Python 8 Hours

Variables, expressions and statements, Conditional execution& Iteration.

Teaching-Learning Process:

Pedagogy: Lab and Lecture method.

Module – 3 Programming constructs/data structures 8 Hours

Data structures: Lists, Dictionaries, Tuples, Functions, Strings & Files, Pandas Data Structure.

Teaching-Learning Process:

Pedagogy: Lab and Lecture method.

Module – 4 Pattern matching & regular expression 8 Hours

Pattern matching & regular expression: Character matching, extracting data, Combining searching and extracting, Escape character.

Teaching-Learning Process:

Pedagogy: Chalk and talk method, PowerPoint Presentation.

Module – 5 Numpy & Pandas 8 Hours

Numpy: -Understanding data types in python, basics of NumPy arrays, computation on NumPy arrays: universal functions. Pandas: -Introducing to pandas data structures, essential functionality, summarizing and computing descriptive statistics, handling missing data, Pandas Data Frame Basics & Data structure.

Teaching-Learning Process:

Pedagogy: Lab and Lecture method.

Course Outcomes: At the end of the course the student will be able to:
CO1: Interpret classification and clustering techniques for handling large data in business objectives.
CO2: Illustrate looping, control statements in python.
CO3: Apply python data structures - lists, tuples, dictionaries and pandas for representing compound data in business applications.
CO4: Demonstrate the concept of pattern matching using regular expression in business objectives.
CO5: Apply the concept of numpy and pandas data structures in business objectives.

Assessment Details

Continuous Internal Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
		Textbooks		
1	Data Mining -Concepts and Techniques	Jiawei Han, MichelineKamber, Jian Pei	Morgan Kaufmann Publisher	3rd Edition 2012
2	“Python for Everybody: Exploring Data Using Python 3	Charles R. Severance	CreateSpace Independent Publishing Platform,	1st Edition 2016
3	"Think Python: How to Think Like a Computer Scientist”	Allen B. Downey	Green Tea Press	2nd Edition 2015

Semester: III

Course Name: Data Warehousing

Course Code	**21MBADA304**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**

Module – 1 System Processes 8 Hours

Introduction, Typical process flow within a data warehouse, Extract & load process, Clean and Transform data, Backup & archive process, Query management process.

Teaching-Learning Process:

Pedagogy: Lab and Lecture method.

Module –2 Process Architecture 8 Hours

Introduction, Load manager, Warehouse manager, Query Manager, Detailed information, Summary information, Meta data, Data marting.

Teaching-Learning Process:

Pedagogy: Lab and Lecture method.

Module – 3 Design 8 Hours

Introduction, Starflake schemas, Identifying facts & dimensions, Designing fact tables, Designing the starflake schema, Query redirection, Multidimensional schemas, Horizontal partitioning, and Vertical partitioning. Why aggregate, What is an aggregation?, Designing summary tables.

Teaching-Learning Process:

Pedagogy: Lab and Lecture method.

Module – 4 Data Marting 8 Hours

Introduction, When is a data mart appropriate, Designing data marts, Costs of data marting. Meta Data- Data transformation & load, Data management, Query generation, Metadata & tools. Hardware architecture –Process, Server hardware, Network hardware, Client hardware, Backup & Recovery –Definitions, Hardware, Software, Backup strategies, Testing the strategy, Disaster recovery.

Teaching-Learning Process:

Pedagogy: Lab and Lecture method.

Module – 5 Capacity Planning 8 Hours

Introduction, Process, Estimating the load Tuning the data warehouse – Introduction, Assessing the performance, Tuning the data load, Tuning queries, Testing the data warehouse – Introduction, Developing the test plan, Testing backup recovery, Testing the operational environment, Testing the database, Testing the application, Logistics of the test.

Teaching-Learning Process:

Pedagogy: Lab and Lecture method.

Course Outcomes: At the end of the course the student will be able to:
CO1: Describe the functionality of various data warehousing component.
CO2: Discuss warehousing architecture and tools for systematically organizing large database and use their data to make strategic decisions.
CO3: Demonstrate the data marts repositories for large amount of transactional data for business applications.
CO4: Discover interesting patterns from large amounts of data for predictions and classification.
CO5: Develop a test plan for testing the various business applications.

Assessment Details

Continuous Internal Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Data Warehousing in the real world	Sam Anahory	Pearson education	Seventh edition 2003.
2	Data Warehousing, Data Mining & OLAP	Alex Berson, Stephen J Smith	TMH	
3				
Reference Books				
1	Data mining & Ware housing	I Singh	Khanna Publishing house.	

Semester: III

Course Name: Decision Support System

Course Code	**21MBADA305**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of pedagogy	**40**	**Total Marks**	**100**

Module – 1 Decision Making and Computerized Support 8 Hours

Managerial decision making and information systems, the need for computerized decision support and the supporting technologies, the concept of decision support systems, executive information support systems, expert systems and intelligent agents, the evolution and attributes of computerized decision aids, decision making: introduction and definitions, systems, models, a preview of modeling process, the intelligence phase, the design phase.
Teaching-Learning Process:
Pedagogy: Lab and Lecture method.

Module –2 Decision Making, Systems and Modeling 8 Hours

Decision making: the implementation phase, how decisions are supported, alternative decision-making models, personality types, gender, human cognition and decision styles. What is a DSS?, characteristics and capabilities of DSS, components of DSS, the data management subsystem, the model management subsystem, the user interface (dialog) subsystem, distinguishing DSS from management science and MIS, DSS classifications.
Teaching-Learning Process:
Pedagogy: Lab and Lecture method.

Module – 3 Decision Support System Development 8 Hours

Introduction to DSS development, the traditional system development life cycle, alternate development methodologies, prototyping: the DSS development methodology, DSS technology levels and tools, DSS development tool selection, end user-developed DSS.
Teaching-Learning Process:
Pedagogy: Lab and Lecture method.

Module – 4 Collaborative Computing Technologies: Group Support Systems 8 Hours

Group decision making, communication and collaboration, communication support, collaboration support: computer-supported cooperative work, Group Support Systems, Group Support Systems technologies, Group systems, the GSS meeting process, dstance learning, creativity and idea generation, GSS and collaborative computing issues and research, enterprise systems: concepts and definitions, the evolution of

executive and enterprise information systems, executives' roles and their information needs, characteristics and capabilities of executive support systems, comparing and integrating EIS and DSS.
Teaching-Learning Process:
Pedagogy: Lab and Lecture method.

Module – 5 Knowledge Management 8 Hours

Introduction to knowledge management, knowledge, organizational learning and organizational memory, knowledge management, the Chief knowledge Officer, knowledge management development, knowledge management methods, technologies and tools, knowledge success, knowledge management and artificial intelligence, electronic document management, knowledge engineering, difficulties in knowledge acquisition, methods of knowledge acquisition; an overview, interviews, tracking methods, observations and other manual methods.
Teaching-Learning Process:
Pedagogy: Lab and Lecture method.

Course Outcomes: At the end of the course the student will be able to:
CO1: Describe the fundamental concepts of Decision Support Systems.
CO2: Discuss the components of Decision Support Systems.
CO3: Demonstrate Decision Support Systems life cycle and tools used for development of Applications
CO4: Illustrate group support system technologies for developing collaborative applications to make appropriate decisions
CO5: Design integrated decision support systems for business applications.

Assessment Details

Continuous Internal Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Decision Support System and Intelligent systems	Efraim Turban, Jay E. Aronson	Pearson Education	6th edition 2001.
2	Decision Support Systems,	Sprague R.H. Jr and H.J. Watson:	Prentice Hall	4th Edition,1996.
Reference Books				
1	Decision Support Systems	R. Jayashankar	Tata Mc Graw Hill.	--
2	Decision Support Systems	Janakiraman and Sarukesi	Prentice Hall of India, New Delhi	--

Semester: III

Course Name: Digital Transformation

Course Code	**21MBADA306**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**

Module – 1 The Key Forces for Change 8 Hours

Relentless, accelerating change, Transformed competitive contexts, Transformed consumer contexts, Transformed company contexts , The agile context model , The key challenge: rates of change, How digital disrupts-The lifecycle of a technology, Why businesses get disrupted: the ambiguity zone, Defining digital.

Teaching-Learning Process:

Pedagogy: Lab and Lecture Method.

Module –2 Defining Digital Transformation 8 Hours

What digital transformation is NOT, What good looks like: a maturity model for change, The agile formula, Digital-native processes - Design thinking , Agile , Lean, The principles of agile business, Developing a learning culture, Learning to unlearn, Fixed and growth mindsets, Embedding reflection time.

Teaching-Learning Process:

Pedagogy: Lab and Lecture Method.

Module – 3 Agile Strategy and Planning 8 Hours

The key to good strategy, Emergent and deliberate strategy, The balance between vision and iteration, The customer-centric organization, 'P' is for Prioritization, Strategy as an ever, changing algorithm, Discovery-driven planning.

Teaching-Learning Process:

Pedagogy: Lab and Lecture Method.

Module – 4 Linking Strategy to Execution 8 Hours

The five questions, strategy and tactic trees, OKRs: bringing the team with you, Sprint working as a driver of change, Data-driven decision-making, technology as a barrier to change, technology as an enabler of change, Agile budgeting.

Teaching-Learning Process:

Pedagogy: Lab and Lecture Method.

Module – 5 The Transformation Journey 8 Hours

The five dimensions of change, Dimension one: personal, Dimension two: principles, Dimension three: process, Dimension four: practice, Dimension five: pace, Staying agile.

Teaching-Learning Process:

Pedagogy: Lab and Lecture Method.

Course Outcomes: At the end of the course the student will be able to:
CO1: Discuss the key forces for change in technology.
CO2: Illustrate the digital transformation process.
CO3: Develop the agile strategy for any business objectives
CO4: Analyse the linking strategy for decision making in business applications
CO5: Demonstrate the transformation dimensions for technological change

Assessment Details

Continuous Internal Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
		Textbooks		
1	Building the Agile Business Through Digital Transformation	NEIL PERKIN, PETER ABRAHAM	Kogan Page Limited	2017

Semester: III

Course Name: Basics of Logistics and Supply Chain Management

Course Code:	**21MBALS301**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Fundamental of Marketing Management.
- Basic knowledge of Transportation.
- Basics of Retail Management.

Module – 1 Supply Chain Management 8 Hours

Supply Chain Concepts: Objectives of Supply Chain, Stages of Supply Chain, Value Chain Process, Cycle View of Supply Chain Process, Key Issues in SCM, Supply Chain Drivers and Obstacles, Supply Chain Strategies – Push & Pull Supply Chain Strategies, Best Practices in SCM.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.

Skill Enrichment Exercises: Draft & Present Best Practices of Supply Chain Management from top 5 corporates

Module – 2 Logistics 8 Hours

Logistics: Evolution, Objectives, Components and Functions of Logistics Management, Distribution Related Issues and Challenges; Transportation- Functions, Costs and Mode; Network Design in the Supply Chain, Factors affecting Network Design Decisions, Containerization, Cross Docking, Hub &Spoke, Distributed Warehouses.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.

Skill Enrichment Exercises: Prepare Pro-forma of Commercial Invoice, Dock Receipt, and Bill of Lading with Imaginary details.

Module – 3 Supply Chain Performance 8 Hours

Supply Chain Performance: Bullwhip Effect and Reduction, Reasons for measuring performance, Dimensions for measuring performance management, Performance Measurement: Measurement, Techniques of Measuring Supply Chain Performance: SCOR Model, Balanced Scorecard, Activity Based Costing (ABC), Benchmarking, Logistics Scoreboard, Economic Value Analysis

Global Supply Chain: Driving forces of Global Supply Chain management, Important Factors Influences Global Supply Chain, sourcing decision in Global SCM: benefit and key issues, Trend

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.

Skill Enrichment Exercises: Draft & Present Tools of Performance Measurement

Module – 4 Warehousing & Supply Chain CRM 8 Hours

Warehousing: Concept and Types, importance/role, Strategic issues affecting warehousing, Warehouse operations, Packaging and unit loads,WarehouseDesign, Facility Location &Network Design, Outsourcing- Nature and Concept, Strategic Decision to Outsourcing, Third Party Logistics(3PL), Fourth Party Logistics(4PL). Supply Chain and CRM- Linkage, IT Infrastructure Used for Supply Chain and CRM, Functional Components for CRM, Green Supply Chain Management, Supply Chain Sustainability.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises: Present Overview of Major Warehousing Companies in India**

Module – 5 International Logistics 8 Hours

Logistics and Environment, Methods and tools facilitating International Logistics, challenges, Integrated Supply Chain and Logistics Value Chain, Logistics Industry in India.Sourcing Decisions in Global SCM- Logistics, Trends, Key Issues in Global Sourcing, Factors influencing Outsourcing.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises: Present Various Documents Required for International Logistics**

Course Outcomes: At the end of the course the student will be able to:

CO1: Apply the concepts of Supply Chain Management. **CO2:** Analyze various functions of Logistics Management. **CO3:** Evaluate tools of performance measurement. **CO4:** Design appropriate warehousing strategies for an organization. **CO5:**Construct the process of integrated supply chain management with international logistics prospective

Assessment Details

Continuous Internal Evaluation(CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B) The following are the Alternate Assessment Tools and not limited to: Quiz, Mini-Project Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.

- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Supply Chain Management: Strategy, Planning and Operation	Chopra, Sunil, Meindl, Peter and Kalra, D. V	Pearson Education	Recent Edition
2	Supply Chain Management	Altekar, Rahul V.	PHI Learning Private Limited	Recent Edition
3	Supply Chain Management	Ballou, Ronald H.	Pearson Education	Recent Edition
4.	Integrated Supply Chain and Logistics Management	Rajat K. Baisya	Sage	2020
5	Supply Chain Management- Text and Cases	Janat Shah	Pearson	Latest edition
6	Logistics & Distribution Management	Alan Rushton, Phil Croucher, Peter Bake	Kogan Page Limited	5th EDITION ISBN 978 0 7494 6627 5 E-ISBN 978 0 7494 6628 2
Reference Books				
1	Supply Chain Management	Sahay, B.S.	Macmillan	Recent Edition
2	Business Logistics Management.	Ballou, R.H.	Prentice-Hall Inc.	Recent Edition
3	Logistical Management	Bowersox D.J., Closs D.J.	McGraw-Hill, 1996	

Semester: III

Course Name: Warehouse Management

Course Code	**21MBALS302**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Students should have basic concepts of logistics & supply chain.
- Fundamentals of Marketing
- Basics of Distribution Channel Management.

Module – 1 Introduction to Warehousing Concepts 06Hours

Role of warehouse-types of warehouse- warehouse location- Need for warehousing- Supply chain trends affecting warehouse –Warehouse functions- Role of warehouse manager.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercises: Identify different types of Warehouse functions and roles.

Module – 2 Warehouse Process 10 Hours

Warehouse process – pick up preparation-Receiving - Pre-receipt - In- handling - Preparation - offloading - Checking - Cross-docking - Quality control - Put-away - Pick preparation - Pick area layout - Picking strategies and equipment -order picking methods - Warehouse processes Replenishment to dispatch- Value adding services - Indirect activities - Stock management - Stock or Inventory counting - Perpetual inventory counts - Security - Returns processing – Dispatch.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercises: Pick a company of choice and prepare a detailed report on warehouse process.

Module – 3 Inventory Management 06 Hours

Functions of Inventory - Concept, various costs associated with inventory, EOQ, buffer stock, lead time reduction, reorder point / re-order level fixation, Classification of Inventory- Methods of Controlling Stock Levels- Always Better Control (ABC) Inventory system- Types of Inventory, Alternative approach for classification of inventories, components of inventory decisions, inventory cost management, business response to stock out, replenishment of inventory, material requirements planning.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercises: Students are Studying the role of technology that helps

warehouse managers in Inventory Management decisions.

Module – 4 Warehouse Functions and Design 10 Hours

Functions of Warehouse-Introduction, Receiving, prepacking, transporting to the appropriate storing place, storage, order picking, packaging or pricing, sorting, consolidation and shipping. Roles and responsibilities of manager, Benefits of Warehousing-Economic benefits – Consolidation and break bulk, cross docking , processing and stock piling-Operational benefits – stock spotting , assortment, mixing, Warehouse Location and Design: Introduction, Site analysis, Product mix consideration, Warehouse design, Design criteria, Storage plan, Aisle width decisions
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:** Create and design a warehousing information system that encompasses the competencies in storage and warehouse management.

Module – 5 Material Handling and Warehouse safety 12 Hours

Material handling- Product movement- concept- costs-product load activity—dispatch activity unload activity-control device-impact of the computer technology automatic identification-issues and trends in product transport--Packaging - Pallet - Stretch wraps - Cartons – Labeling- Health and safety- Risk assessment - Layout and design - Fire safety- Slips and trips - Manual handling - Working at height - Vehicles - Forklift trucks - Warehouse equipment legislation. Warehouse safety check list- Warehouse Environment- Energy production - - Product waste - waste disposal - Hazardous waste- Sustainable warehouse Management.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:** Students are asked to identify the warehouse security issues and strategies to solve the issues.

Course Outcomes: At the end of the course the student will be able to:

CO1: Apply and Understand the role of the warehouse and warehouse manager in today's supply chain **CO2:**Analyze the various warehouse processes, strategies, and methods for appropriate decisions. **CO3:**Evaluate the various storage inventory management methods. **CO4:** Design the specific warehousewith determining the functions. **CO5:**Develop and enhance effective inventory control,material handling, and warehouse safetytechniques.

Assessment Details

Continuous Internal Evaluation (CIE):

	Components	Number	Weightage	Max. Marks

(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B) The following are the Alternate Assessment Tools and not limited to: Quiz, Mini-Project Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

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- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Warehouse Management: A Complete Guide to Improve Efficiency and Minimizing Cost in the Modern Warehouse.	Gwynne Richards	Kegan page limited	Latest 2016
2	A Supply Chain Logistics Program for Warehouse Management	David E. Mulchy & Joachim Sidon (2008)	Auerbachian Publications	2008
Reference Books				
1	Supply Chain Logistics Management	Bowersox, D.J., Closs, D.J., Cooper, M.B., & Bowersox, J.C.	McGraw Hill/Irwin.	4e , 2013
2	The Introduction to Materials Management.	Arnold, J.R., Chapman, S.N	Prentice-Hall	7e 2012
3	Managing Supply Chains: A Logistics Approach.	Coyle, J.J., Jr. Langley, C.J., Novack, R.A, & Gibson, B.J	McGrawHill.	9e,2013

Semester: III

Course Name: Purchasing and Strategic Sourcing

Course Code	**21MBALS303**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Basic Logistics and supply chain management theory,
- Basics of Economics theory
- Basics of Business Environment

Module – 1 Purchasing Operations and Structure 06 Hours

The purchasing and supply process - Introduction to purchasing and SCM - Strategic supply management roles and responsibilities - Improving the procure to pay process - Approval, contract and purchase order preparation - Types of purchases - Purchasing policy and procedures -Policy overview - Purchasing policies - Purchasing procedures.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:** Students are asked to prepare a detailed report on purchasing system and process of any two companies.

Module – 2 Supply Management Integration and Strategic Sourcing 10 Hours

Internal integration - External integration - The critical role of cross functional scouring teams - Integrating supply management, and suppliers to develop new products and services – purchasing/supply management organizational structure - Purchasing position within the organizational structure - Supply management and commodity strategy development - Aligning supply management and enterprise objectives - Category strategy management - Types of supply management strategies - E-reverse auctions - Evolving sourcing strategies.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:** To conduct an interview with Purchasing manager and collect the data on Supply chain integration and Strategic sourcing.

Module – 3 Supplier Evaluation and Selection 10 Hours

Supplier Evaluation and Selection Process, Recognize the Need for Supplier Selection, Identify Key Sourcing Requirements, Determine Sourcing Strategy, Identify Potential Supply Sources, Sourcing Alternatives, Limit Suppliers in Selection Pool, Determine the Method of Supplier Evaluation and Selection, Select Supplier and Reach Agreement
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:** Comparison of selection of Industrial products any two

suppliers.

Module – 4 Negotiations 06 Hours

Definition, Negotiation Framework Identify: Identify or Anticipate a Purchase Requirement, Determine If Negotiation Is Required, Plan for the Negotiation, Conduct the Negotiation, and Execute the Agreement Negotiation Planning: Develop Specific Objectives, Analyze Each Party's Strengths and Weaknesses, Gather Relevant Information, Recognize Your Counterpart's Needs, Identify Facts and Issues, Establish a Position on Each Issue, Develop the Negotiation Strategy and Accompanying, Tactics, Brief Other Personnel, Practice the Negotiation Concessions Power in Negotiation: Sources of Negotiation Power, Concessions, Negotiation Tactics: Trying to Reach Agreement, Win-Win Negotiation
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:**To conduct student role play on Negotiation Skills.

Module – 5 Contract Management 08 Hours

Introduction, Elements of a Contract, How to Write a Contract, Types of Contracts: Fixed-Price Contracts Cost-Based Contracts, Considerations when Selecting Contract. Types Long-Term Contracts in Alliances and Partnerships Benefits of Long-Term Contracts Risks of Long-Term Contracts, Contingency Elements of Long-Term Contracts, Consulting Contracts, Construction Contracts, Other Types of Contracts , Settling Contractual Disputes, Arbitration Other Forms of Conflict Resolution
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:** Students are assignment for drafting the important contact formats

Course Outcomes: At the end of the course the student will be able to:

CO1: Applying the basics of purchasing operations and Purchasing policies in business **CO2:**Analyze the Methods Supply Integration with Sourcing. **CO3:** Evaluate various Supplier and Selectionprocess for appropriate business situation **CO4:**Design thenegotiation Process and Procedure for appropriate business situation. **CO5:**Comprehend he most appropriate contract techniques to be used when dealing the potential suppliers

Assessment Details

Continuous Internal Evaluation (CIE):

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B) The following are the Alternate Assessment Tools and not limited to: Quiz, Mini-Project Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative

and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	In Coterms Exports Coartind and Pricing with Practical Guide to in Co-Terms	Parasram	Jain Book	1st Edition, 6th Edition, 2010.
2	Purchasing and Supply Management. Additional cases and articles will be assigned	Johnson, Leenders, and Flynn	McGraw Hill. 6	14th Edition
Reference Books				
1	Global Operations &Logistics:Text& Cases-Dornier	John Wiley	Pearson Education	2nd Edition, 2013
2	Designing & Managing Supply Chain-Concepts, Strategies	David Simchi-Levi	Tata McGraw Hill	8th Edition, 2000

Semester: III

Course Name: Inventory Management

Course Code	**21MBALS304**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Fundamentals of logistics Management
- Basics of ManufacturingProcess.
- Elementary concepts of Economics.

Module – 1: Basics of Inventory Management 8 hours

Inventory concepts, Pressures for Low Inventory, Pressures for High Inventory, Role of inventory in Operations, Types of inventory – seasonal, decoupling, cyclic, pipeline, Safety stock. Inventory costs – carrying costs, ordering costs, shortage costs.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercise: Students are asked to discuss on importance of inventory management.

Module – 2:Inventory Control systems 8 Hours

Need for inventory Control system,Meaning of inventory control system, Importance and methods of inventory control, Continuous Review (Q) systems, and Periodic Review (P) systems, Issues in the P and Q systems of inventory control.ABC Classification system, FNS, Safety stock, JIT, Implementation Process and Benefits.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercise: Students must under a mini project and submit a report on company's inventory control

Module – 3:Economic Order Quantity Models 8 Hours

The Basic EOQ Model, Production Quantity Model, Computer Solution of EOQ model, Quantity Discounts, Reorder Point, Safety Stocks and Replenishment Policy on Safety Stock, Service Level, Reorder point with variable demand, Order quantity for periodic inventory system, Order quantity with variable demand.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercise: Students asked to derive models of EOQ and solve problems.

Module – 4:Just-In-Time 8 Hours

Principles of just-in-time, Core logic of JIT, Main features for stocks, Achieving just-in-timeoperations, and Other effects of JIT, Benefits and disadvantages of JIT, Comparison with other methods of inventory management. KANBAN as a control tool. Vendor managed inventory. Optimum Level of Product Availability and Methods in Determining Product Availability.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercise:** Case study on Just in time of Toyota

Module – 5:Make Or Buy Decisions 8 Hours

Introduction, Make Versus Buy: The Strategic Approach Identifying Core Processes, Factors influencing Make Or Buy Decisions-cost, The Business Process Route, The Product Architecture Route, Versus Hierarchy, Economies of Scale Agency Cost, Transaction Cost, Incomplete Contracts, Integrative Framework of Market Versus Hierarchy The Make-Versus-Buy Continuum,
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercise: Students are asked to discuss on** Logistics Management and Procurement.

Course Outcomes: The student should be able to:

CO1: Assess the key concepts associated with Inventory Management.
CO2: Analyze various types of inventory, and inventory costs.
CO3: Evaluate the Economic Order Quantity and stock levels under variousconditions.
CO4: Design the various methods of inventory control.
CO5: Comprehend factors influencing Make or Buy decisions and solve problems based on ABC classification of inventory.

Assessment Details

CIE:

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B) The following are the Alternate Assessment Tools and not limited to: Quiz, Mini-Project Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.

- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks Recommended				
1	Operations Management: Theory and Practice	B Mahadevan	Pearson	Latest edition
2	Operations Management-Process and Value Chains	Krajewski, Ritzman, Malhotra,	Pearson.	
3	Operations Management: Quality and Competitiveness in a Global Environment	Russell and Taylor	Wiley India.	
4	Supply Chain Management-Text and Cases	Janat Shah	Pearson	Latest edition
Reference books				
1	Essentials of Inventory Management	Max Muller	JAICO Publishing	
2	Just-in-Time Manufacturing,	Korgaonker	Macmillan	
3	Inventory Control and Management	Donald Waters	Wiley Student Edition.	

Semester: III

Course Name: Supply Chain Management and Risk Modeling

Course Code	**21MBALS305**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Fundamentals of Supply Chain Management.
- Understanding towards role Risk modeling.
- Different basic Supply chain models.

Module – 1 Introduction of Supply Chain Management **8 hours**

Definition of Supply Chain Management - Integrated Planning and Models – Supply Chain Models & modeling Systems – Supply Chain Decision Databases – Data Aggressions, Facility Data, Transportation Network data, Supplier Data – Integrating Supply Chain & Demand Management, Price & location Sensitive Revenue Curves. Supply Chain Performance and Control-Throughput Dollar Days(TDD) and Inventory Dollar Days(IDD).

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.

Skill Enrichment Exercise: Students are asked to list out the core components of supply chain management.

Module – 2 Fundamentals of Optimization Models **8 Hours**

Linear programming Modeling –Resource Allocation Model, Infeasible & Unbounded Models, Multi period Resource Allocation Model, Network Models., Properties of Linear Programming Models, Dual Linear Programming Model, Parametric 7Sensitivity Analysis., Spread sheet and Multiple Objective, unified Optimization, Stochastic Programming. Mixed Integer Programming Modeling, Distribution Centre Location Models, Supply Chain Network Optimization Models, Optimization Software.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.

Skill Enrichment Exercise: Students are asked to submit a report onapplication areas of Optimization Models.

Module – 3 Supply Chain Models and its Strategies **8 Hours**

Optimization Models for Competitive Analysis, Scenario Planning, Decision trees & Stochastic Programming, Supply Chain Strategies for managing Product Variety. Simulation Models & Systems – Deterministic Simulation, Monte Carlo Simulation, Simulation Software, Simulation Vs Optimization, Inventory Theory Models – Deterministic Models, Probabilistic Models, ABC Classification. External Integration Strategies in Supply Chain. Supply Chain Maturity Reference Model.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercise: Case Study of John Deere on supply chain cost reduction.

Module – 4 Risk and Management 8 Hours

Risk in the Supply Chain, Features of Risk, Decisions & Risk, Structure of Decisions, and Decisions with uncertainty, Risk, ignorance, Managing Risk Structure of a Supply Chain, Increasing Risk, and Trends in Supply Chain Management. Integration of supply Chains, Cost Reduction, Agile logistics, E – Business, Globalization, Outsourcing, Changing practices in Logistics. Approaches to Risk Management.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercise: Case study on changingpractices in logistics at Noatum Logistics

Module – 5: Identifying Risks 8 Hours

Types of Risks, Tools for analyzing past events, Operations, Problems with Risk Identification, Measuring Risk, Consequences of Risk, responding to Risk – Alternative responses, Defining Options, Choosing the best response, Implementation & Activation, A Network view of Risk – Shared Risks, achieving an Integrated approach, Analyzing & responding to risks. Pricing and Revenue Management in Supply Chain.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercise: Students are asked to discuss various types of risks in Logistics.

Course Outcomes: The student should be able to:

CO1: Assess supply chain and its nature and apply the appropriate integration process.
CO2: Analyze various optimization models for the Logistics&Supply ChainManagement.
CO3: Evaluate the optimization of various strategies.
CO4: Comprehendthe various risks associated in Supply ChainManagement.
CO5: Communicate the types of operational risks in Supply ChainManagement.

Assessment Details

CIE:

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B) The following are the Alternate Assessment Tools and not limited to: Quiz, Mini-Project Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative

and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
TextbooksRecommended				
1	Trent Supply Chain Risk Management: An Emerging Discipline	Gregory L. Schlegel , Robert J	(Resource Management) Hardcover – Import	3 Nov 2014.
2	Supply Chain Risk: A Handbook of Assessment, Management	George A. Zsidisin and Bob Ritchie	International Series in Operations Research & Management Science	) Hardcover – Import, 20th October 2008
Reference books				
1	Supply Chain Risk Management,	Donald Waters	Published by the Chartered Institute of Logistics & Transport, U.K	2007 ISBN-13: 978-0-7494-4854-7 ISBN-10: 0-7494-4854-7
2	Modeling the Supply Chain,	Jeremy F.Shapiro,	Duxbury.	

Semester: III

Course Name: E-Logistics

Course Code	**21MBALS306**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Fundamentals of logistics
- Understanding towards Supply chain of various industry.
- Basics of Computer Fundamentals

Module – 1: Introduction to E-logistics 8 hours

Definition of logistics management, Supply Chain Management for E-Commerce and its Challenges and Solutions, forward logistics – Reverse logistics – Logistics renovation toward E-logistics – importance of E-logistics – New trends and technology in logistics.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercise: Students are asked to choose a Manufacturing unit and mention the logistics process of that unit.

Module – 2: E-logistics method of documentation 8 Hours

Electronic data interchange – Personal computer – Enterprise resource planning systems – The internet, intranets and extranets – The world wide web – Web-enabled relational databases, data warehouses and data marts – Decision support systems.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercise: Students are asked discuss about ERP and its applications.

Module – 3: ASNs – Tracking Systems 8 Hours

Satellite global positioning systems (GPS) and geographic information systems (GIS) – Bar-coding and scanning – Electronic signature technology – Wireless technology – Radio frequency identification (RFID).IT and Its Role in SCM.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercise: Students are asked to prepare a report on the Pros-Cons of GPS/wireless technology.

Module – 4: Electronic procurement (e-procurement) 8 Hours

Transport and delivery management – Packing and order management – Inventory and warehousing – Application architecture of Customer relationship management (CRM) – E-business logistics and its benefits. IT enabled Supply Chain Transformation

Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercise:** Case study of Starbucks on Supply chain

Module – 5: Forward E-logistics 8Hours

Reverse E-logistics – Challenges of E-logistics – environmental issues – e-business strategy – Application for E-logistics – Business to business – Business to consumers – Exception based status alert – Transportation documentation.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercise:** Students are asked to discuss about the challenges in e-logistics.

Course Outcomes: The student should be able to:

CO1: Assess the Importance concepts of E-logistics and its applications **CO2:** Analyze the different method of e-logistics documentation **CO3:** Evaluate the importance of e-logistics tracking. **CO4:** Comprehend the different models of e-procurement and CRM. **CO5:** Communicate the appropriate uses of reverse E-logistics.

Assessment Details

CIE:

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B) The following are the Alternate Assessment Tools and not limited to: Quiz, Mini-Project Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				

1	Realizing e-business with application service providers	Louis columbus	LWC publication.	
2	Selling in Manufacturing and Logistics	Mike Jones,Ken Guest	Udible Publishers	
Reference Books				
1	E-business: Key Issues, Applications and Technologies	B Stanford	Ohmsha publication.	
2	E-Logistics	Wang Yingli	Kogan Page Ltd	

Semester: III

Course Name: Financial Markets & Services

Course Code	**21MBAFM301**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Knowledge of the basic concepts of Financial Markets
- Knowledge of capital markets & money markets.
- Good Communication skills
- Decision-making skills

Module-1 Overview of Indian Financial System 8 Hours

Financial system – An overview, Indian financial system, Global financial system, Financial services – An overview, Financial Institutions, Clearing Corporation of India Limited (CCIL), Credit Information Bureau of India Limited (CIBIL), Discount and Finance House of India Limited (DFHI), Over-the-Counter Exchange of India Limited (OTCEI), National Securities Depository Limited (NSDL), National Housing Bank (NHB), Demat account.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study **Skill Enrichment Exercise: Study the structure of Indian Financial System**

Module – 2 Capital Markets 8 Hours

Primary Capital markets – An overview, Capital market instruments, Capital market reforms, New issues market – A Conceptual framework and new issues market evaluation, Prospectus, Global depository receipts Secondary Capital Markets: Stock exchange – An overview, Stock exchange trading.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study **Skill Enrichment Exercise: Study the working of Stock Exchange**

Module – 3 Money Markets 8 Hours

Money market, Call money market, Commercial paper market, Commercial bill market, Certificate of deposit (CD), Treasury bills, Govt. Securities market. Role and responsibilities of RBI with respect to money market, RBI monetary policy and its relevance to money market.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study **Skill Enrichment Exercises: Study the components of Indian Money Market**

Module – 4 Asset/Fund Based Financial Services 8 Hours

Lease Finance- Conceptual and Regulatory Framework, Classification and Financial leasing, Hire Purchase and Consumer Credit, Factoring and Forfeiting , Housing finance, Venture capital financing.
Teaching-Learning Process:

Pedagogy: Lecture, Case Study **Skill Enrichment Exercise: Study the various types of fund based financial services**

Module – 5 Fee-based / Advisory services 8 Hours

Investment Banking – Introduction, Functions and activities of Merchant bankers, Lead Managers, underwriting, bankers to an issue, debenture trustees, portfolio managers. Challenges faced by investment bankers. Stock broking, Custodial Services, Depository system, Credit rating – Role of agencies, Process, regulations.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study **Skill Enrichment Exercise: Study the various types of fee based financial services**

Course Outcomes: At the end of the course the student will be able to:

CO1: Apply the concept of Indian Financial System and its significance. CO2: Analyze the capital markets and their instruments. CO3: Evaluate the role of money markets and the ethical dimensions in the financial markets. CO4: Design the various types of fund based financial services. CO5: Communicate the various types of advisory services in Indian Financial Markets.

Assessment Details

Continuous Internal Evaluation(CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, SelfE-Learning withCertifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theoryin the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Financial Markets, Institutions and Financial Services	Clifford Gomez	Prentice Hall India Pvt. Ltd	1st Edition, 2008
2	Management of Banking and Financial Services	Justin Paul and Padmalatha Suresh	Pearson	2012
3	Indian Financial System	Bharati V Pathak	Pearson Publications	5th edition, 2018
Reference Books				
1	Financial Services	M.Y.Khan	Mc Graw Hill	10th Edition
2	Financial Services and System	Gurusamy	Cengage	2012

Semester: III

Course Name: Investment Management

Course Code	**21MBAFM302**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Fundamental of economics and mathematics
- Basics of finance
- Understanding of Saving and Investment

Module – 1 Introduction to Investment	**8 Hours**
Concept of Investment, Objective, characteristics .Investment Versus Speculation. Various Investment avenues .Sources of Investment information. Financial Versus Non-Financial Investments. Security versus Non-Security form of Investment. Investment Management Process. Various Types of Security Markets and their Function. Role of SEBI with regard to Secondary Markets. The Role and Functions of Various Players and Agencies in the Secondary Market & Primary Market. Mechanics of Security Trading. Strategies of the Great Masters: The Timeless Wisdom. (Only Theory)	
Teaching-Learning Process:	
Pedagogy: Case Study **Skill Enrichment Exercise:** Visit SBI and BSE/NSE website and identify various asset class	

Module – 2 Return and Risk Concepts	**8 Hours**
Concept, Types of Risk- Systematic risk & Unsystematic Risk, Risk-Return Relationship, Concept of diversifiable risk and non-diversifiable risk. Types of return-Growth & Income. Calculation of Return and Risk of Individual Security & Portfolio of stocks (group of 2 & 3 assets).	
Teaching-Learning Process:	
Pedagogy: Case Study **Skill Enrichment Exercise:** Use data analysis tool pack in excel to measure risk and return	

Module – 3 Security Analysis	**8 Hours**
Security Analysis Fundamental analysis (EIC analysis)**,** Technical Analysis (Charts, Indicators, Patterns). Market Efficiency theory ,Concept of Behavioral Finance	
Teaching-Learning Process:	
Pedagogy: Case Study **Skill Enrichment Exercise:** Use capitaline database for financial statement analysis	

Module – 4 Valuation of Securities **8 Hours**

Bond Valuation, Bond Duration, Bond Management Strategies. Preference Shares- Valuation. Equity Shares- Concept, Valuation, Dividend Valuation Models .P/E Ratio valuation model. CAPM (Assumptions, equation, CML Vs SML, Application of CML, SML and Beta estimations).Arbitrage Pricing Model: Equation, Assumption.
Teaching-Learning Process:
Pedagogy: Excel based calculation, websites of NSE/BSE **Skill Enrichment Exercise:** Estimate regression analysis and correlation using Excel

Module – 5 Portfolio Theory **8 Hours**

Markowitz Model: Diversification, Portfolio Return, Portfolio Risk, Efficient Frontier. Sharpe's Single Index Model .Sharpe's Optimum Portfolio Construction. Portfolio Revision Strategies – Objectives, Performance plans. Portfolio performance Evaluation: Measures of portfolio performance (Theory & Problems). Portfolio Management Strategies: Active and Passive Portfolio Management strategy. Portfolio Revision:
Teaching-Learning Process:
Pedagogy: Case study discussion, articles from Magazine and research related. **Skill Enrichment Exercise:** Use www.amfiindia.com website for mutual fund evaluation

Course Outcomes: At the end of the course the student will be able to:

CO1: Assess the capital market and various instruments for investment.
CO2: Evaluate risk & return associated with Investments.
CO3: Analyze Company, Industry and Economy framework for Investment management.
CO4: Evaluate equity and dividend valuation.
CO5: Apply the theories, tools and techniques of portfolio management.

Assessment Details

Continuous Internal Evaluation (CIE) :

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.

- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 40 % Theory and 60 % Numerical in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Investment Analysis and Portfolio Management	Prasanna Chandra	McGraw Hill	6/e and 2014
2	Security Analysis & Portfolio Management	J Kevin	Tata McGraw Hill Education	2014
3	Analysis of Investments & Management	Reilly & Brown	Cengage Publications,	10/e, 2017
Reference Books				
1	Investments	ZviBodie, Kane, Marcus & Mohanty	Tata McGraw Hill Education	8/e, 2010
2	Security Analysis & Portfolio Management	Punithavathy Pandian	Vikas Publications	2/e, 2018
3	The Intelligent Investor	Benjamin Graham	Harper Business	2013

Semester: III

Course Name: Direct Taxation

Course Code	**21MBAFM303**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Basic Knowledge of Annual Budget.
- Fundamentals of Macro Economics.
- Awareness of Government policies

Module – 1 Tax Fundamentals **5 Hours**

Basic Concepts and definitions, Assesse, person, previous year, assessment year, Basis of charge and scope of total income, Residential Status and Incidence of Tax (Problems on residential Status of Individual Assesse)
Teaching-Learning Process:
Pedagogy: Lectures, Case Study, etc., **Skill Enrichment Exercise:** Analyze the recent annual budget and tax rates

Module – 2 Incomes From Salaries & HP **10 Hours**

Meaning of Salary, Allowances, Valuation & Taxability of Perquisites, Death cum Retirement benefits, Deductions against Salary. **Income from House Property** : Annual Value, Deductions U/S 24, Interest on loan; Standard Deduction; SOP; Let out Property (Problems on salary & HP Income).
Teaching-Learning Process:
Pedagogy: Lectures, Case Study, etc., **Skill Enrichment Exercise:** Apply the various deductions of salary and HP to determine the taxable income

Module – 3 Income From Business /Profession **8 Hours**

Income under the head Profit and Gains of Business or Professions and its computation- basic method of accounting- scheme of business deductions/ allowance- deemed profits- maintenance of books, Depreciation. (Problems on computation of income from business/ profession of Individual Assesse and Depreciation).
Teaching-Learning Process:
Pedagogy: Lectures, Case Study, etc., **Skill Enrichment Exercise:** Asses the Company's Financial statements to understand the Depreciation allowance

Module - 4 Income from Capital Gain & Other sources **8 Hours**

Income under capital gain, basis of charge, transfer of capital asset, inclusion & exclusion from capital asset, capital gain, computation of capital gain, deductions from capital gains. (Problems on computation of Income from capital gain). Income from Other Sources: Only theory
Teaching-Learning Process:

Pedagogy: Lectures, Case Study etc.,
Skill Enrichment Exercise: Explore the calculations of income from lottery and other residual incomes and TDS thereby

Module – 5 Computation of Total Income **9 Hours**

Permissible deductions under section 80C to 80U; Setoff and carry forward of losses. Computation of tax liability of Individuals.
(Problems on Computation of taxable Income and tax liability of Individuals).

Teaching-Learning Process:

Pedagogy: Lectures, Case Study etc.,
Skill Enrichment Exercise: Determine the Taxable income and tax liability using individual details of incomes .

Course Outcomes: At the end of the course the student will be able to:
CO1: Apply theoretical knowledge of income tax for determination of residential status.
CO2: Analyze the Income from salary and HP of individual Assesse.
CO3: Evaluation of Income from PGBP
CO4: Communicate the Capital gain and other sources income statement
CO5: Prepare the statement of total income of individual Assesse

Assessment Details

CIE:

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50. The question paper will have 8 full questions carrying equal marks.

- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions, selecting four full question from question number one to seven and question number eight is compulsory.
- 40 percent theory and 60 percent problems in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Direct Taxes Law and practice	Vinod Singhania and Kapil Singhania	Taxman Publications	Latest Edition
2	Income Tax including Tax planning & Management	Dr. H.C. Mehrotra and Dr. S.P Goyal	Sahithya Bhawan Publication	Latest Edition
3	Income Tax	Dr G B Baligar Prof. S L Patil	Ashok Prakashan	2022-23
Reference Books				
1	Students Handbook on Taxation	T N Manoharan	Snow White Publications Pvt. Ltd	Latest Edition
2	Income Tax Law & Practice	B.B.Lal & N. Vashisht	Pearson	Latest Edition
3	Problems & Solutions in income tax	H.C.Mehrotra & S.P.Goyal	Sahithya Bhavan Publications	Latest Edition

Semester: III

Course Name: Advanced Financial Management

Course Code	**21MBAFM304**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Knowledge of financial environment so as to allow a proper assessment the circumstances encountered by the firm.
- Knowledge of tools which accurately determine the financial condition of the firm
- Knowledge of funding avenues available to the firm

Module – 1: Capital Structure Decisions **8 Hours**

Capital structure & market value of a firm. Theories of capital structure – NI approach, NOI approach, Modigliani Miller approach, Traditional approach. Planning the capital structure: EBIT and EPS analysis. ROI & ROE analysis. (Theory and Problems).

Teaching-Learning Process:

Pedagogy: Lecture, Case Study
Skill Enrichment Exercise: Study capital structure of companies and its impact on EPS

Module – 2 Dividend Policy **8 Hours**

Dividend policy – Theories of dividend policy: relevance and irrelevance dividend decision. Walter's & Gordon's model, Modigliani & Miller approach. Dividend policies – stable dividend, stable payout and growth. Bonus shares and stock split corporate dividend behavior. (Theory and Problems).

Teaching-Learning Process:

Pedagogy: Lecture, Case Study
Skill Enrichment Exercise: Study dividend policy of companies and its impact on shareholders' wealth

Module – 3 Working Capital Management Policy **8 Hours**

Working capital management – Determination of level of current assets. Sources for financing working capital. Bank finance for working capital. (No problems on estimation of working capital). Working capital financing: Short term financing of working capital, long term financing of working capital. Working capital leverage. (Theory)

Teaching-Learning Process:

Pedagogy: Lecture, Case Study
Skill Enrichment Exercise: Study the working capital financing provided by a Bank and submit the report on the same

Module – 4 Inventory Management	**8 Hours**
Inventory Management: Determinations of inventory control levels: ordering, reordering, danger level. EOQ model. Pricing of raw material. Monitoring and control of inventories, ABC Analysis. (Theory and problems)	
Teaching-Learning Process:	
Pedagogy: Lecture, Case Study **Skill Enrichment Exercise: Study the Inventory management of Manufacturing Companies**	

Module – 5 Cash Management	**8 Hours**
Cash Management – Forecasting cash flows – Cash budgets, long-term cash forecasting, monitoring collections and receivables, optimal cash balances – Baumol model, Miller-Orr model, Strategies for managing surplus fund. (Theory and Problems)	
Teaching-Learning Process:	
Pedagogy: Lecture, Case Study **Skill Enrichment Exercise:• Study the annual report of any two companies and prepare a cash budget for next year**	

Course Outcomes: At the end of the course the student will be able to:

CO1: Apply the capital structure theories for decision making
CO2: Analyze dividend policy of the firm
CO3: Evaluate the working capital in an organization
CO4: Design the techniques of Inventory Management
CO5: Develop the optimal cash management model

Assessment Details

Continuous Internal Evaluation(CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 40 percent theory and 60 percent problems in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Financial Management	M.Y.Khan&P.K.Jain	TMH	6/e, 2011
2	Financial Management	Prasanna Chandra	TMH	8/e, 2011
3	Corporate Finance-Text and Cases	Vishwanath S.R.	Sage Publishing	3/e, 2019
Reference Books				
1	Financial Management & Policy	Vanhorne	Pearson	12/e,
2	Financial Planning: Theory and Practice	Sid Mittra, Shailendra Kumar Rai, Anandi P Sahu& Harry Starn, Jr.	Sage Publishing	1/e, 2015
3	Financial Management-A	Rajesh Kothari	Sage Publishing	2/e, 2017

Semester: III

Course Name: Mergers & Acquisitions and Business Valuation

Course Code	**21MBAFM305**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Fundamental of Business Environment
- Basics of Strategic management.
- Understanding of financing activities

Module – 1 M & A **8 Hours**

Introduction -Types of mergers–Merger Motives, - Buy side M & A, - Financing Options for buyer, -Sell-side M & A, -Factoring affecting Sell-Side M & A, -Sell Side Process. Meaning and types of acquisition/takeovers (Friendly and Hostile takeovers), -Anti-takeover strategies.

Teaching-Learning Process:

Pedagogy: Case Study
Skill Enrichment Exercise: Case Study on Reliance Industries Ltd: Growth Through M & A Tool

Module – 2 Financing Options **8 Hours**

Financing Aspects of M & A: Introduction, Normal equity, Differential Voting Equity, Preference Shares, Debt Financing, Retained Earnings, Euro Bonds, Foreign Bonds, Depository Receipts, External Commercial Borrowings (ECBs) , Equipment Financing ,Leasing and Hire Purchase, Types of Leasing, Advantage. (Theory only)

Teaching-Learning Process:

PedagogyCase Study
Skill Enrichment Exercise: Case study on Tata Steel Corus Refinances of Loan

Module – 3 Financial Evaluation of M & A **8 Hours**

Merger as a capital budgeting-Business valuation approaches-asset based, market based and income based approaches-Exchange Ratio (Swap Ratio)-Methods of determining exchange rate.

(Theory and Problems).

Teaching-Learning Process:

Pedagogy: Case Study
Skill Enrichment Exercise Case study on Changing value of Ranbaxy: Daiichi's to Sun Pharma.

Module – 4 Corporate Restructuring and M & A **8 Hours**

Introduction, Organizational Restructuring, Financing Restructuring, Portfolio Restructuring, Mergers and Acquisitions as an Inorganic Growth Tool. (Theory only)

Teaching-Learning Process:
Pedagogy: case study **Skill Enrichment Exercise** Case study on Corporate Restructuring at Aditya Birla Group.

Module – 5 M & A Trends and Empirical Studies **8 Hours**

Introduction,Global Trends in M& A, Regional Trends and Insights ,Cross –Border M & As, M & A activities in Emerging Markets(Comparative study of India and China), Sectors Analysis of M & A Trends.
Teaching-Learning Process:
Pedagogy: Case study discussion, articles from Magazine and research related. **Skill Enrichment Exercise** Case Study on Vodafone and Hutch Deal

Course Outcomes: At the end of the course the student will be able to:

CO1: Analyze M&A with its different classifications, strategies, theories and **CO2:**Evaluate financial implication of M&A **CO3:**Analyze the results after financial evaluation of M &A **CO4:** Critically evaluate different types of M&A, takeover and antitakeover strategies **CO5:** Evaluate the Merger Process and identify the stages involved in it.

Assessment Details

Continuous Internal Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 80 percent theory and 20 % of Numerical Problems in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Mergers and Acquisitions: Valuations, Leveraged Buyouts, and Financing	Sheeba Kapil Kanwal N Kapil	Wiley	1/e ,2016
2	Mergers Acquisitions & Corporate Restructuring - Strategies & Practices	Rabi Narayan Kar and Minakshi	Taxmann’s	3/e, 2017
3	Mergers, Acquisitions and Takeovers	H.R.Machiraju	New Age International Publishers	1/e, 2010
Reference Books				
1	Mergers et.al.-Issues, Implications, and Case Law in Corporate Restructuring	Ramanujam S.	Tata McGraw Hill Publishing House	2000
2	Takeovers, Restructuring and Corporate Governance	Weston, Mitchell and Mulherin	Pearson Education	4/e , 2003.
3	Mergers, Acquisitions and Corporate Restructuring: Text and Cases	Chandrashekar, Krishnamurti & Vishwanath S	Sage Publications	2/e, 2018

Semester: III

Course Name: Financial Modeling

Course Code	**21MBAFM306**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Fundamental of economics and finance
- Basics of MS Excel
- Understanding of Capital market activities

Module – 1 Overview of Financial Model	**8 Hours**
Concept of Financial model, types of financial models, Application of financial models, role of financial modeler, Best practices in financial modeling. Financial Modeling Life Cycle. Testing the financial model.	
Teaching-Learning Process:	
Pedagogy: Case Study **Skill Enrichment Exercise: Study the application of financial models in forecasting**	

Module – 2 Modeling Excel Functions	**8 Hours**
Formatting of Excel Sheets, Filter and Sort. Use of Excel Formula Function (IF, AND, SUMIF, COUNTIF, AVERAGEIF, SUMIFS, VLOOKUP, MATCH, INDEX, OFFSET, and CHOOSE, Date and Time Functions).	
Teaching-Learning Process:	
Pedagogy: Case Study **Skill Enrichment Exercise: Apply the Excel shortcut keys**	

Module – 3 Advanced Modeling Tools and Techniques	**8 Hours**
Extrapolation, Histogram Data. Charts and Graphs. Table formula and Pivot tables. Advance financial models: Introduction to valuation, types of valuation methods, financial statement modeling using Excel. Time value of Money & Loan amortization: PV, FV, and PMT.	
Teaching-Learning Process:	
Pedagogy: Case Study **Skill Enrichment Exercise: Prepare loan amortization model**	

Module – 4 Portfolio Analysis	**8 Hours**
Calculation of risk & return for individual stock and Portfolio. Meaning and assumption of Simple regression analysis, Application of Simple regression analysis, multiple regression analysis, Covariance and co-efficient of correlation. Descriptive statistics.	
Teaching-Learning Process:	
Pedagogy: Case Study , Excel based calculation, websites of NSE/BSE **Skill Enrichment Exercise: Prepare a portfolio using small and medium cap stocks**	

Module – 5 Econometrics	**8 Hours**
Meaning, Why a separate discipline, Types of Econometrics, Methodology of Econometrics, The Nature and Sources of Data for Economic Analysis. Measurement Scales of Variables.	
Teaching-Learning Process:	
Pedagogy: Case study discussion, articles from Magazine and research related. **Skill Enrichment Exercise: Apply the unit root tests to time series data**	

Course Outcomes: At the end of the course the student will be able to:

CO1: Gain the knowledge of financial function and its importance in investment decisions
CO2: Identify the various techniques for financial decision making using excel
CO3: Comprehend the application of financial models in decision making.
CO4: Analyze the regression equation and its usage in policy decisions
CO5: Evaluate the risk return estimation and its implication in decision making

Assessment Details

Continuous Internal Evaluation (CIE):

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Hands-On Financial Modeling with Microsoft Excel 2019	ShmuelOluwa	Packt	2019
2	The Handbook of Financial Modeling	Jack Avon	Apress	2003
	Basic Econometrics	Damodar Gujarati	McgrawHill	2018
Reference Books				
1	Oxford Guide to Financial Modeling	Thomas S. Y Ho, Sang Bin Lee	Oxford University Press	2003
2	Introductory Econometrics :A Modern approach	Jeffrey M .Wooldridge	Cengage Publication	7/e
3	Mastering Financial Modelling in Microsoft Excel	Alastair L Day	Pearson Publication	2/e and 2008

Semester: III

Course Name: Behavioural Marketing

Course Code	**21MBAMM301**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Fundamentals of Consumer Behaviour.
- Understanding towards Culture and Subculture.
- Understanding of internal and external influences

Module – 1: Introduction to the study of Consumer Behaviour — 8 Hours

Meaning & Definition of Consumer Behaviour, Difference between Consumer & Customer, Nature & characteristics of Indian Consumers, Consumerism: meaning, Consumer Movement in India, Rights & Responsibilities of consumers in India, Benefits of consumerism.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercise:** Students are asked to list out the Rights & Responsibilities of consumers in India.

Module – 2: Models of Consumer Behaviour — 8 Hours

Input-Process-Output Model, Nicosia Model, Howard Sheth Model, Engel-Kollat-Blackwell Models of Consumer Behaviour, Internal Influences, External Influences. Consumer Decision Making: Consumer Buying Decision Process, Levels of Consumer Decision Making – Four views of consumer decision making. On-line Decision Making: Meaning & Process/Stages. Situational Influences- Nature of Situational Influence, Situational Characteristics and consumption behaviour.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercise:** Students are asked to study the Process of consumer buying decision making.

Module – 3: Individual Influences on Consumer Behaviour — 8 Hours

Motivation: Basics of Motivation, Needs, Goals, Positive & Negative Motivation, Rational Vs Emotional motives, Motivation Process, Arousal of motives, Selection of goals. Motivation Theories and Marketing Strategy - Maslow’s Hierarchy of Needs, McGuire’s Psychological Motives. **Personality:** Basics of Personality, **Perception:** Basics of Perception & Marketing implications, Elements of Perception, Dynamics of Perception, Influence of perception on CB. **Attitude:** Basics of attitude, the nature of attitude, Models of Attitude and Marketing Implication, (Tri-component Model of attitude, Multi attribute attitude models. Elaboration Likelihood Model). **Persuasive Communication:** Communications strategy, Target Audience, Media Strategy, Message strategies, Message structure and presentation.
Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercise:** Case Study on buying behavior

Module – 4: External Influences on Consumer Behaviour 8 Hours

Social Class: Social Class Basics, What is Social Class? (Social class & Social status, the dynamics of status consumption, Features of Social Class, Five Social-Class Categories in India. **Culture:** Basics, Meaning, Characteristics, Factors affecting culture, Role of customs, values and beliefs in Consumer Behaviour. Subculture: Meaning, Types of subcultures. Cross Culture - Cross-cultural consumer analysis – Cross cultural marketing strategy: Cross-cultural marketing problems in India, Strategies to overcome cross-cultural problems. **Groups:** Meaning and Nature of Groups, Types Family: The changing structure of family, Family decision making and consumption related roles, Dynamics of husband-wife decision making, **Reference Groups:** Understanding the power & benefits of reference groups, Factors that affect reference group influence, Types of reference group, Reference Group Appeals.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercise:** Case study on cross culture aspects

Module – 5: Diffusion of Innovation 8 Hours

Opinion Leadership: Dynamics of opinion leadership process, Measurement of opinion leadership, Market Mavens, Opinion Leadership & Marketing Strategy, Creation of Opinion Leaders. **Diffusion Process:** Adoption Process, Stages, categories of adopters, Post Purchase Processes. Customer Relationship Management- Meaning & Significance of CRM, Types of CRM Strategies for building relationship marketing, e-CRM, Meaning, Importance of e-CRM, Difference Between CRM & e-CRM
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercise:** Students are asked to discuss the process of E-CRM

Course Outcomes: At the end of the course the student will be able to:

CO1: Comprehend the background and vital concepts for understanding Consumer Behaviour **CO2:** Identify the role of variables of Consumer models and decision making process **CO3:**Identifying the psychological and Behavioural practices adopted by Organizations to enhance Consumer Behaviour. **CO4:**Comprehend the role of External Influences on Consumer Behaviour **CO5:** Analyze the diffusion of innovation process.

Assessment Details

CIE:

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Consumer Behavior	Leon Schiff man, LesslieKanuk,	10/e, Pearson,	Latest Edition
2	Consumer Behaviour: A Managerial	Perspective Dr. Dheeraj Sharma, Jagdish N Sheth, Banwari Mittal.	1/e, Cengage Learning	Latest Edition
Reference Books				
1	Consumer Behavior in Indian Perspective	Suja Nair	Himalaya Publications	2015
2	Consumer Behavior: Building Marketing Strategy – Del I.	Hawkins, & Others	11/e, TMH	Latest Edition
3	Consumer Behavior	Satish K. Batra& S H H Kazmi,	Excel Books.	Latest Edition

Semester: III

Course Name: Advanced Retail Management

Course Code	21MBAMM302	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:0:2	SEE Marks	50
Credits	03	Exam Hours	03
Total Hours of Pedagogy	40	Max Marks	100

Pre-requisites:

- Fundamentals of Marketing Management
- Basics of Marketing Channel Management
- Basics of E-Commerce

Module – 1 Basics of Retailing 06 Hours

Introduction and Perspectives on Retailing, World of Retailing, Retail management, introduction, meaning, characteristics, emergence of organizations of retailing - Types of Retailers (Retail Formats) - Multichannel Retailing -Customer Buying Behaviour, Historical Perspective, Role of retailing, Trends in retailing, FDI in Retail - Problems of Indian Retailing - Current Scenario.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercise: Interview a retail shop floor employee in a retail store and write brief report on trends, importance and problems of retailing.

Module – 2 Theories of Retailing 08 Hours

Wheel of retailing, The Retail Accordion, Melting Pot Theory, Polarization theory
Retailing strategy for Setting up Retail organization and planning:
Retail Market Strategy - Financial Strategy - Site & Locations (Size and space allocation, location strategy, factors Affecting the location of Retail, Retail location Research and Techniques, Objectives of Good store Design.)
Human Resource Management, Information Systems and Supply chain management & Logistics

Teaching-Learning Process:

Pedagogy: : Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercise: Visit kirana store and a supermarket and compare the following: a) Store arrangement b) No of brands carried c) Pricing policies – are discounts given? d) Service – personal or impersonal?

Module – 3 Store Management and Visual Merchandising 08 Hours

Store Management: Responsibilities of Store Manager, Store Security, Parking Space Problem at Retail Centers, Store Record and Accounting System, Coding System, Material Handling in Stores, Management of Modern retails –Store Layout, design: Types of Layouts, Role of Visual Merchandiser, Visual Merchandising Techniques, Controlling Costs and Reducing Inventories Loss, Exteriors, Interiors Customer Service,

Planning Merchandise Assortments -Buying systems -Buying merchandise and Retail Communication Mix.
Teaching-Learning Process:
Pedagogy: : Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercise:** Visit at least three kirana stores in your neighborhood (around 2 kms) meet 15-20 retail customers and discuss the importance of location, pricing, credit policy, etc
Module – 4 Retail Pricing and Retail Research 08 Hours
Retail Pricing: Factors influencing retail pricing, Retail pricing strategies, Retail promotion strategies Relationship Marketing in Retailing: Management & Evaluation of Relationships in Retailing, Research in Retailing: Importance of Research in Retailing, Trends in Retail Research, Areas of Retail Research. Customer Audits, Brand Management in retailing Internationalization of Retailing: Evolution of International Retailing, Motives of International Retailing, International Retail Environment, Issues in International Retailing
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercise:** Draft a detailed report on comparing Physical store retailer and online about the price and pricing strategies.
Module – 5 Foundation of e-Retailing 10 Hours
Meaning, Definition, Transition from Traditional Marketing to e-Marketing, Demographics and Targeting, Adaptability and Closed – Loop Marketing, Advantages of e-Retailing, Shortcomings of e-Retailing. **E-Retailing:** The Application Domain: e-Retailing Practices, e-Retailing Application Perspective, e-Retailing Online Merchandising Techniques, Online Store Front, Creating Look & Feel, Online Brand Management, Online Purchasing.The Current Trends: Current Trend Analysis and Measures, Current Status of Online Retailing, e-Retailing Statistics
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercise:** Presentation on any retailing company specific to E-CRM

Course Outcomes: At the end of the course the student will be able to:

CO1: Visualize and apply the contemporary retail management, issues, and strategies to scenario for retail application. CO2: Comprehend and Analyzing the strategic significance components in functionalizing of retail organization. CO 3: Evaluating the various methods and techniques of Retail operations and Store management. CO4: Develop comprehensive research plans by accessing the retail scenario for business decisions. CO5: Effectively communicate the Marketing mix in the age of E-retailing.

Assessment Details

CIE:

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Retail Management	Levy &Weitz	McGraw Hill	Latest Edition
2	Retail Management-A Global Perspective: Text and Cases	Dr.Harjit Singh	S.Chand	Reprint 2018
3	Retail Management	Chetan Bajaj	Oxford University press	Latest Edition
4	e-Retailing	Eleonora Pantano Bang Nguyen Charles Dennis Sabine Gerlach	Routledge Ebusiness	Latest Edition
Reference Books				
1	Integrated Retail Management	James R. Ogden & Denise Trodden, Biztantr	Latest Edition	Integrated Retail Management
2	Retail Marketing Management	Dravid Gilbert,	Pearson Education	Latest Edition
3	Retailing and E-Tailing	Ramesh Mittal, Ruchi Nayyar, S. L. Gupta	International Book House	1st Edition

Semester: III

Course Name: Services Marketing

Course Code	**21MBAMM303**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Fundamentals of Marketing Management.
- Understanding towards Services Industry.
- Differences among Product and Services.

Module – 1 Introduction to Services 08 Hours

What are services, Why service marketing, Difference in goods and service in marketing, Myths about services, Concept of service marketing triangle, Service marketing mix, GAP models of service.

Consumer Behaviour in Services: Search, Experience and Credence, property, Customer expectation of services, Two levels of expectation, Zone of tolerance, Factors influencing customer expectation of services Customer perception of Services- Factors that influence customer perception of service, Service encounters, Customer satisfaction, Service quality, Strategies for influencing customer perception.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.

Skill Enrichment Exercise:

Students are asked to choose a service industry of their and list out the different service organizations in the particular industry.

Module – 2 Understanding Customer Expectations through Market Research 08 Hours

Using marketing research to understand customer expectation, Types of service research, Building customer relationship through retention strategies, Market segmentation- Process & targeting in services, Retention strategies Monitoring relationship, 3 levels of retention strategies.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.

Skill Enrichment Exercise:

Students are asked to conduct an in-depth study towards understanding the customer expectation of any service customer has availed recently.

Module – 3 Customer Defined Service Standards 08 Hours

“Hard” & “Soft” standards, challenges of matching supply & demand in capacity, four common types of constraints facing services, optimum v/s maximum use of capacity, strategies for matching capacity & demand. Yield management-balancing capacity utilization, pricing. Waiting line strategies- four basic Waiting line strategies. Leadership &Measurement system for market driven service performance-key reasons for GAP-2 service leadership- Creation of service vision and implementation, Service quality as profit strategy, Role of service quality In offensive and defensive marketing.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercise:
Students are asked to prepare service blueprints for any service of their choice.

Module – 4 Employee Role in Service Designing and Delivery 08 Hours

Boundary spanning roles, Emotional labour, Source of conflict, Quality- productivity trade off, Strategies for closing GAP 3.
Customer's role in service delivery-Importance of customer & customer's role in service delivery, Strategies for enhancing-Customer participation, Delivery through intermediaries-Key intermediaries for service delivery, Intermediary control strategies.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercise:
Students are asked to identify any existing services, locate loopholes in the service design and suggest modifications.

Module – 5 Services Marketing Communication 08 Hours

Role of services marketing communication- Key reasons for GAP 4 involving communication, four categories of strategies to match service promises with delivery.
Pricing of services- Role of price and value in provider GAP 4, Role of non-monitory cost, Price as an indicator of service quality –Approaches to pricing services, pricing strategies, SERVQUAL Model.
Physical evidence in services: Importance of Physical Evidence, Elements of Physical Evidence, Physical Evidence Strategies, Guidelines for Physical Evidence.
Service scapes: Types of service scapes-Objective and Goals of services capes Role of services capes, Approaches for understanding service scapes effects,
Frame work for understanding services capes & its effect on behaviour-Guidance for physical evidence strategies.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercise: Mini Project – On measuring SERVQUAL

Course Outcomes: At the end of the course the student will be able to:

CO1: Utilize the concepts of the services marketing with the overview of customer behavior towards service industry.
CO 2: Analyze the customer expectation by appropriate tools and frame works.
CO 3: Evaluate and develop the service outcomes with appropriate leadership strategies.
CO 4: Design the service process with focus on employees and customer relationships.
CO 5: Communicate service contents by appropriate element of service infrastructure over viewing the service scape and physical evidence.

Assessment Details

CIE:

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Services Marketing	Valarie A Zeithmal & Mary Jo Bitner	McGraw Hill	6th Edition
2	Services Marketing	Christopher Lovelock	Pearson Education	Latest Edition
Reference Books				
1	Services Marketing	Rajendra Nargundkar	McGraw Hill	Latest Edition
2	Services Marketing	Hoffman & Bateson	Cengage Learning	Latest Edition
3	Services Marketing: Operation, Management and Strategy	Strategy-Kenneth E Clow& David L. Kurtz	Biztantra	Latest Edition

Semester: III

Course Name: Marketing Research & Analytics

Course Code	**21MBAMM304**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:
- Fundamentals of Marketing Analytics
- Understanding towards uses of analytics
- Basis of Marketing Research

Module – 1: Introduction of Marketing Analytics **8 Hours**

Introduction of Marketing Analytics, Market Segmentation Variables, Market Segmentation Types, Marketing Data Landscape, Data for Segmentation, Analytics for Need Based Segmentation - Voice of the Customer, managing “Voice of the Customer” Data, Customer Co-Creation, RFM Analysis, Life Cycle Segmentation, Cross Tabulation Segmentation, Clustering, Conjoint Analysis Segmentation, The Cluster Analysis + Discriminant Analysis Approach.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercise: Students are asked to list the 5 uses of marketing analytics.

Module – 2: Marketing Information System **8 Hours**

Importance, Relevance of MkIS, Marketing Research (MR) and MkIS, The Marketing information systems and its subsystems, four components: user interfaces, application software, databases, and system support. Advantages & disadvantages of marketing information systems. Internal reporting. Approaches to Choosing Target Segment/s: Rationale for Segment Targeting, Analytics for Perceptual Mapping and Product Positioning.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercise: Students are asked to discuss about application of MkIS

Module – 3: Marketing Research Database **8 Hours**

Definition of Marketing Research Database**,** Use of Decision Support Systems in Marketing Research, Data base & Data warehousing. The three Vs: Volume, Velocity & Varity, The Fourth V: Value. Elements of data base, types of data base, using marketing data base for marketing intelligence, ways to gather consumer data, Data Mining, benefits of data mining, Big Data Analysis, Descriptive Analysis, Prescriptive Analysis, Key challenges of Big Data Integration.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercise: Students are asked to differentiate between Descriptive and Prescriptive analytics and their applications.

Module – 4: Types of Marketing Research	**8 Hours**
Introduction, Consumer Market Research, Business-to-Business Market Research, Product Research, Pricing Research, Motivational Research, Distribution Research, Advertising Research, Media research, Sales Analysis and Forecasting.	
Teaching-Learning Process:	
Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercise:** Students are asked to undergo a Mini project on Product Research.	

Module – 5: Modeling New Marketing Initiatives	**8 Hours**
Introduction to modeling, evaluating new ad channels, Modeling tips and best practices, Projecting ad revenue, projecting organic follower revenue, Projecting expenses, calculating net profit and breakeven, Understanding ROI, calculating returns, creating a single-variable sensitivity table.	
Teaching-Learning Process:	
Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercise:** Students are asked discuss about the ROI of a Project	

Course Outcomes: At the end of the course the student will be able to:

CO1: Describe the use of Voice of the Customer data in making data driven marketing decisions. **CO2:** Demonstrate an understanding of utility theory to measure customer preferences and choices. **CO3:** Identify what customers' value in a product, and assess what they are willing to pay for it. **CO4:**Illustrate the use of various tools and frameworks to solve strategic marketing problems using marketing data. **CO5:** Analyze the most effective target markets and incorporates the key tools of Marketing Analytics.

Assessment Details

CIE:

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each fullquestionisfor20marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Marketing Research an Application Orientation-	Naresk K	Pearson,	Malhotra,6/e, 2013.
2	Marketing Analytics: Data-Driven Techniques with Microsoft Excel	Wayne L. Winston	John wiley & Sons	2014
Reference Books				
1	Predictive Analytics, Data Mining and Big Data- S.	Finlay, Palgrave	Macmillan Publishing.	2014
2	Marketing Analytics: A Practical Guide to Improving Consumer Insights Using Data Techniques	Mike Grigsby	McGraw Hill	. 2018

Semester: III

Course Name: Business Marketing

Course Code	**21MBAMM305**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites: Students should have basic knowledge of

- Basic concepts of marketing.
- Understanding of various business units.
- Analyzing of typical business situations.
- Understanding of business plans and its actions.

Module 1 - Dimensions of Industrial Marketing & Buying 08 Hours

Nature of Industrial Marketing, Industrial Marketing vs. Consumer Marketing, Economics of Industrial demand – The Resellers Market – The Industrial Marketing Concept, Understanding Industrial Markets, Types of Industrial Markets. Organizational buying Activity, Buying models and buying centre concept, Inter Personal Dynamics of Industrial Buying Behavior, Roles of Buying centre, Ethics in Purchasing.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercises: Ethical issues in Business marketing will be discussed with examples.

Module 2 - Market Segmentation & Product Planning 08 Hours

Choosing Target Segments, Positioning, Differentiated and Un-Differentiated Markets, Concentrated and Niche Markets, Positioning Strategies, Difference between Industrial Market Research and Consumer Market Research.
Product Planning: Developing Product Strategy, AnalyzingIndustrial Product Life Cycle, Developing Strategies for new and existingproducts Business Service Marketing: Special Challenges.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercises: Case study on positioning strategies.

Module 3 - Formulating Channel Strategy & Pricing Strategies 08 Hours

Industrial Distributor, Definition, Geographical Distribution, Size Characteristics, operating characteristics, Role of Sales Agent and their drawbacks, choice of the right Distributors.
Pricing strategies: Price Determinants, Factors that Influence the Pricing Strategies, concept of learning curves, Pricing Strategies, Competitive Bidding, and Leasing.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential

Learning.
Skill Enrichment Exercises: Visit a retail store and observe the roles of sales agent and the strategies they use to market products/services and write a report.

Module 4 - The Promotional Strategies 08 Hours

Advertising in Industrial Markets, uses, Message Formulation, policies, media,budgetary support, evaluation of advertising- sales Promotion- Use of Sales Promotion in Industrial Markets, trade shows and exhibitions B 2 B Forms of E-Commerce.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercises: Students can visit industrial/ B2B trade shows or exhibition and prepare a report.

Module 5 - Management of Sales Force & B2B in E-Commerce 08 Hours

Managing the Industrial Sales Force, Organizing and controlling the industrial sales force activity, planning for the sales force Deployment. Personal Selling: Selecting and Recruitment of Industrial sales person, sales training, Directing, Motivating, Task Assignment, Compensation, Measuring the Effectiveness of Sales Force.
B2B Through E-commerce: B2B form of E-commerce, models for B2B e-commerce, marketing strategy for electronic market place.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercises: Case study on importance of e-commerce in industrial marketing.

Course Outcomes: At the end of the course the student will be able to:

CO1: To Apply the fundamental related concepts of business & industrial marketing.
CO2: To analyze the different business buying behaviour of industrial customers.
CO3: To evaluate the business situations in the context of buyer- seller relationship.
CO4: To Design an integrated marketing communications plan for pricing & promoting B2B products or services.
CO5: To build Salesforce approaches and models with the significance of e-commerce in business marketing.

Assessment Details
Continuous Internal Evaluation(CIE):

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)
The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based

learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Business Marketing	Krishna K Havaldar	Tata McGraw Hill Publication	Latest Edition
2	Industrial Marketing	Robert R Reeder & Reeder	Prentice –Hall, International Publication	2nd Edition
Reference Books				
1	Business Marketing	Frank G Bingham	Tata McGraw Hill Publication	Latest Edition
2	Industrial Marketing	Mukherjee H S	Excel Books Publication	Latest Edition
3	Business Marketing Management	Michael D Hutt, Thomas W Speh	Cengage Learning Publication	Latest Edition

Semester: III

Course Name: TOURISM MARKETING

Course Code	**21MBAMM306**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Fundamentals of Marketing Management.
- Understanding towards Services Marketing.
- Basis of Tourism and Travel Industry.

Module – 1 Basics of Tourism Marketing 06 Hours

Evolution of Marketing – The Tourism Product – Features of Tourism Marketing – Marketing Functions – Market Research – Tourism Marketing Mix.

Teaching-Learning Process:

Pedagogy Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercise: Students are asked to list the 05 companies in Tourism Industry with detailed profile and SWOT analysis of the company**.**

Module – 2 Tourism Consumer 08Hours

Understanding the Market and the Consumer – Marketing Environment – Consumer Behaviour – Buyer Decision Process – Demand Forecasting - Market Segmentation – Targeting – Market Positioning.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercise: Students are asked to discuss the factors affecting consumer motivation and demand in the travel and tourism sector.

Module – 3 Tourism Product Mix 10 Hours

Product Designing – Branding and Packaging – New Product Development – Product Life Cycle. Tourism Pricing: Factors Influencing Pricing – Pricing Objectives – Procedure – Policies – Methods. Tourism Place: Logistics of tourism products – Place of ambience of site in tourism marketing – Accommodation of tourists – Online services in tourism.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercise: Students are asked to assess the importance of the service sector mix elements to the travel and tourism sector.

Module – 4 Tourism Promotion 08 Hours

Advertising: Meaning – Objectives – Deciding Advertising Budget – Advertising Copy/Layout – Media Planning, Selection and Scheduling – Measuring Advertising Effectiveness – Personal Selling: Meaning – Personal Selling Process –Sales Promotion: Methods and Strategies – Direct Marketing – Tele Marketing – Event Marketing – Public Relations – Promotion through Internet.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercise: Analyze the importance of Strategic Marketing planning for a selected travel and tourism business or tourist destination.

Module – 5 Physical Evidence and Process in Tourism 08 Hours

Tourism planner – Tourism arrangement process – Procedure involved in tourism. People in Tourism: Employee behavior in tourism organizations – Tourists orientation – Trends in Tourism Marketing – Marketing of Destinations, Airlines, Hotels, Resorts, and Travel Agencies, Events and other Tourism sub-sectors and products.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercise:** Mini Project – on Travel Digital Channels.

Course Outcomes: At the end of the course the student will be able to:

CO1: Apply the concepts of the marketing with the overview of customer behavior towards tourism industry.
CO2: Analyze the tourism customer expectation by appropriate tools and frame works for devising tourism marketing strategies.
CO3: Evaluate and develop the product mix strategies for tourism business and organizations.
CO4: Design the promotional strategies through advertising, sales promotion and manage the sales force for efficient marketing.
CO5: Communicate the appropriate element of tourism infrastructure over viewing the physical evidence and process.

Assessment Details

CIE:

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Marketing for Hospitality and Tourism	Philip Kotler, Jon Bower, James Maken	Pearson Education	7th Edition
2	Tourism Marketing & Management Handbook - Stephen F. Wilt and Luiz Mountinho	Stephen F. Wilt and Luiz Mountinho	Abhijeet publications	1st Edition
Reference Books				
1	Tourism Marketing (English, Hardcover	Badan B.S, Harish Bhat	Commonwealth Publishers	Latest Edition
2	Tourism Marketing	Dasgupta Devashish)	Pearson Education	Latest Edition

Semester: III

Course Name: Talent Acquisition

Course Code	**21MBAHR301**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Good communication and Presentation Skills.
- Knowledge of Selection process and Tools in the Corporate Sector.
- Basics of Hiring System.

Module – 1 Recruitment Analytics 8 Hours

Concept of Work, Organization's Work and Jobs; Remote Work, Hybrid work and Work from Office, Millennials at the work place; Key Characteristics of Millennials; Types of Millennial; The Evolution of Work Structure; Organizing the Work; Strategic Job Redesign and Its Benefits; Strategic Issues in Recruitment; What makes Bad Recruitment; Overview of the Hiring Process; Recruitment Metrics; Factors Affecting Recruitment; Recruitment Strategy: An Internal Approach; An External Approach; Legal and Ethical Considerations; Organizational Best Practices.

Teaching-Learning Process:

Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.
Skill Enhancement Exercises: Draft a Man Power Planning for a Manufacturing Unit.

Module – 2 Job Analysis & Job Evaluation 8 Hours

Identify the Job to Examine; Determine Appropriate Sources of Information, Collection of Job-Related Data; Job Description; Competency and Competency Ice Berg Model; Why Competency Based Recruitment; Sources of Recruitment; Employer Branding – Meaning and Significance; Social Media- Use of Social Media in Recruitment & Selection; Job Design.

The Job Evaluation Process; Obtain Job KSAOs, Qualifications, Working Conditions, and Essential Duties; Examine Compensable Factors Using the Rating/Weighting Evaluation Method; Determine Overall Job Value; Hay Group—Pioneer in Job Evaluation; Determining Compensation using Job Evaluation Data; Legal and Ethical Considerations for Job Evaluation.

Teaching-Learning Process:

Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.
Skill Enhancement Exercises: Prepare a Job Description for various levels of jobs

Module – 3 Selection and Interview Strategy 8 Hours

Interview Strategy and Process; Millennials Shaping the Recruitment Landscape in the Organizations; Strategies for Recruiting and Selecting Generation Y into the Workforce. Interviewers; Interviewing Techniques; Legal and Ethical Considerations in the Interview Process; The Overall BEI Process; Assessment Centers; Simulations.

Teaching-Learning Process:

Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.

Skill Enhancement Exercises: Design job Advertisements for various levels of jobs

Module – 4 Testing and Assessment 8 Hours

Test related to Assessment of Knowledge, Skills, and Abilities; Personality Assessment; The Birkman Method and MBTI® comparison; Honesty and Integrity Assessment; Various Non-Interviewing Methods- Meaning and Significance; Graphology; Skills Assessment; Games and Group Activity for Leadership Assessment; Administration of Tests and Assessments; Key Interviewer Skills. Recent Trends in Recruitment and Talent Acquisition, Use of Technology in Recruitment & Selection.

Teaching-Learning Process:

Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study**.**
Skill Enhancement Exercises: Prepare Selection Test Questions to identify Skills and Abilities of candidates

Module – 5 Final Assessment & Placement 8 Hours

Unique Recruitment Strategies; Resume, CV and Application Forms; Implications of Using Social Media Content in Hiring Decisions; Background Checks; Reference Checks; Pre-employment Testing; Job Offer; Transitioning from Job Candidate to Employee; Induction; Placement.

Teaching-Learning Process:

Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study**.**
Skill Enhancement Exercises: Draft your Resume

Course Outcomes: At the end of the course the student will be able to:

CO1: Apply the knowledge of recruitment metrics and recruitment analytics in manpower planning of an organization.

CO2: Apply the knowledge of job analysis and various techniques of job analysis in recruitment and selection process.

CO3: Evaluate various selection and interview strategies.

CO4: Construct various selection tests to evaluate ability of candidates in selection process.

CO5: Design various documentations to execute selection process.

Assessment Details

Continuous Internal Evaluation (CIE):

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.

- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	How to Recruit, Incentives and Retain Millennials.	Rohtak	Sage Publications	2019
2	Recruitment and Selection- Strategies for Workforce Planning & Assessment	Carrie A. Picardi	Sage Publication	2019
3	Human Resource Management	R. C. Sharma	Sage Publication	2019
Reference Books				
1	Human Resource Management:	Amitabha Sengupta	Sage Publication	2018
2	Leadership: Theory and Practices	Peter G. Northouse	Sage Publication India Pvt. Ltd	7/e, 2016
3	Performance Management and Appraisal System	T. V Rao	Response Books	2004

Semester: III

Course Name: Human Resource Analytics

Course Code	**21MBAHR302**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:
1. Analytical skills
2. Statistical Proficiency
3. Good Decision Making skills
4. Logical Reasoning

Module-1 Introduction to HR Analytics — 8 Hours

Concept and Definition of Analytics; HRM and Strategy; Reinforcement of HR Strategy factors with HR Analytics; HRM as a Process & System; Transition of HRM to HCM; Sustainable Competitive Advantage through Human Capital; Importance & Benefits of HR Analytics, HR Decision making and HR Analytics; Aligning HR to Business through HR Analytics; Steps for Alignment of HR Analytics with Business Goals and Strategies; Challenges to HR Analysts
Teaching-Learning Process:
Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars **Skill Enrichment Exercise:** Learning insights on importance of Analytics and its strategic alignment with the Business performance

Module – 2 HR Analytics and Data — 8 Hours

HR Data and Data Quality, Employee Data sources; HRIS for HR Decision Making; Levels of HR Analysis, Conducting HR Analytics; HR Data collection; Transforming HR Data in to HR Information; Process of Data collection for HR Analytics & Effective HR Measurement; Analytics Frameworks : LAMP, HCM:21 Model
Teaching-Learning Process:
Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars **Skill Enrichment Exercise:** Discussion on Importance of HR data sources for effective decision making in the organizations

Module – 3 HR Metrics and its Application — 8 Hours

HR Metrics: Meaning, Types: Recruitment Metrics; Training & Development Metrics; Staffing Metrics; HR Dashboards; HR Scorecard; Dashboards: Few Key Excel Add-ins/Functions to Help Create Dashboards, Name Range, The Developer Tab, Form Controls, Important Excel Formulas Useful for Creating Dashboards, VLOOKUP, INDEX, SUMIF, AVERAGEIF and COUNTIF.

Teaching-Learning Process:
Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars **Skill Enrichment Exercise:** Discussion on importance of HR metrics and its practical applicability

Module – 4 HR Analytics Applications 8 Hours

Correlation & Regression: Correlation Analysis, Simple Linear & Multiple Regression Analysis, Interaction Effects. Comparison of Means and ANOVA, One-Sample T-test, Null and Alternate Hypotheses, Paired Sample T-Test, Independent-Sample T-Test, Analysis of Variance, Factor Analysis ; Cluster Analysis Software for Statistical Analysis: MS-Excel, IBM- SPSS, IBM-AMOS, SAS, and R programming and data visualization tools such as Tableau, Ploty, Click view and Fusion Charts
Teaching-Learning Process:
Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars **Skill Enrichment Exercise:** practical application of statistical tools

Module – 5 HR Predictive (RBT **Modeling 8 Hours**

Case study: HR Predictive Modeling; Predictive Analytics Tools & Techniques, Conducting Hypotheses testing using Statistical Software
Teaching-Learning Process:
Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars **Skill Enrichment Exercise:** Practical application of Predictive analysis

Course Outcomes:
CO1: Apply the concepts of Analytics in HR process
CO2: Interpret conceptual knowledge of HRA frameworks, models, and approaches
CO3: Elaborate the use of employees' data set, considering the various concepts and functions of HR facilitating decision making in business context.
CO4: Discuss the application of datafication of HR, by using analytics tools and techniques
CO5: Analyze HR analytics and predictive modeling used in HR functions

Assessment Details

CIE:

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20

	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Practical Applications of HR Analytics 2019	Pratyush, Banerjee; Jatin Pandey; Manish Gupta	SAGE Texts, India	2019
2	HR Analytics-Understanding Theories and Applications	Bhattacharya, Dipak Kumar	SAGE Texts, India	2017
3	Winning on HR Analytics-Leveraging Data for Competitive Advantage	Ramesh, Soundarajan and Kuldeep Singh	Sage Publication India Pvt. Ltd.	2016
4	Applying Advanced Analytics to HR Management Decisions: Methods for Selection, Developing Incentives and Improving Collaboration	Sesil James, C ,	Pearson, New Jersey	2017
5	Predictive Analytics-Mastering the HR Matrix	Martin Edwards and Kirsten Edwards	Kogan Page	2019
Reference Books				
1	Applying Advanced Analytics to HR	Sesil James, C	Pearson, New Jersey	2017

	Management Decisions: Methods for Selection, Developing Incentives and Improving Collaboration			
2	Predictive Analytics- Mastering the HR Matrix,	Martin Edwards and Kirsten Edwards,	Kogan Page,	2019
3	Fundamentals of HR Analytics: A Manual on Becoming HR Analytical	Fermin Diez, Mark Bussin, Venessa Lee, ,	Emerald Publishing Limited	2019

Semester: III

Course Name: Organizational Change Management

Course Code	**21MBAHR303**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Basics of Organizational Behavior.
- Basics of Organization change & Development.
- Knowledge of internal and external environment of business.
- Knowledge of Strategic Management Concepts.

Module – 1 Changing Organizations – Introduction 8 Hours

Nature of 21st Century Organization, Defining Organizational Change, The Roots of Organization Change, Environmental Forces, Driving Change Today, The Implications of Worldwide Trends for Change Management, Four Types of Organizational Change, Planned Changes and Intended Results, Organization Change Roles, Change Initiators, Change Implementers, Change Facilitators, Change Recipients,
Concept of OD, OD in India, OD Activities, Values, Beliefs and Assumptions of OD, Laboratory Training and T-Groups Action Research and Survey Feedback, Employee Involvement, Organizational Culture, Reengineering Organizational Learning, Organizational Effectiveness and Employee Engagement, Defining Values, Values Important to the OD Practitioner, Core Values of OD, Changes to OD Values, Values Statement of OD, Ethical Issues of OD.

Teaching-Learning Process:

Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study**.**
Skill Enhancement Exercises: Discuss Successful OD Interventions of various companies

Module – 2 The Need for Change 7 Hours

Building and Energizing the Need for Change: Organizations as Systems, Levels and Characteristics of Organizational Change, Models of Organizational Change, Systems Theory and Social Construction Approaches, Developing a Knowledge for the Need for Change, Seek Out and Make Sense of Internal - External Data, The Organizations' Readiness for Change, Creating Awareness of the Need for Change, Factors That Block People From Recognizing the Need for Change, Creating a Powerful Vision for Change, The Difference Between an Organizational Vision and a Change Vision.

Teaching-Learning Process:

Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study**.**
Skill Enhancement Exercises: Analyze Business Environment of an Organization

Module – 3 Measuring the Change 7 Hours

Designing Effective Control Systems for Measuring the Change: Using Control Processes to Facilitate Change, Selecting and Deploying Measures, Use Measures that Lead to Challenging but Achievable Goals, Use Measures and Controls that are

Perceived as Fair and Appropriate, Ensure Accurate Data, Control Systems and Change Management, Controls During Design and Early Stages of the Change Project, Measurement Tools to use in Change Process, Strategy Maps, The Balanced Scorecard, Risk Exposure Calculator, Organizational Change Agent, Orienting Yourself to Organization Change, Data Gathering, Diagnosis and Feedback.
Teaching-Learning Process:
Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study. **Skill Enhancement Exercises: Meet and Interact with OD and Change Manager and ask- 10 questions related to Change Management**
Module – 4 Models of Change 10 Hours
Models of Change, Comparison and Critical Analysis of Change Models Plan the Work, Selecting the Correct Path, Engage Others in Action Planning, Working the Plan Ethically and Adaptively, Developing a Communication Plan, Key Principles in Communicating for Change, Transition Management. Ensure Alignment in Your Action Planning, Action Planning Tools: 1) To-Do Lists; 2) Responsibility Charting; 3) Contingency Planning; 4) Surveys and Survey Feedback; 5) Project Planning and Critical Path Methods;6) Force Field and Stakeholder Analysis; 7) Leverage Analysis and 8) Other Change-Management Tools.
Teaching-Learning Process:
Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study. **Skill Enhancement Exercises: Visit an Organization and Interact with Employees in the Organization and discuss Culture Impact on Change process and how it can be managed.**
Module – 5 Master Change Agent 8 Hours
Factors That Influence Change Agent Success, The Interplay of Personal Attributes, Situation, and Vision, Change Leaders and Their Essential Characteristics, Developing into a Change Leader-Intention. Education, Self-Discipline, and Experience, Developmental Stages of Change Leaders, Four Types of Change Leaders, Internal Consultants: Specialists in Change, External Consultants: Specialized, Paid Change Agents, Provide Subject-Matter Expertise, Bring Fresh Perspectives from ideas that have worked elsewhere, provide independent, trustworthy Support, Limitations of External Consultants, Change Teams, Change from the Middle: Everyone Needs to Be a Change Agent, Rules of Thumb for Change Agents, Types of Consulting, Consulting Model, OD Practitioners, The Organization Development Consulting Profession, The OD Consulting Process and Action Research
Teaching-Learning Process:
Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study. **Skill Enhancement Exercises: Prepare a Change Management Model for Manufacturing Company**

Course Outcomes: At the end of the course the student will be able to:

CO1: Apply the understanding of OD aspects in private and public sectors in India.
CO2: Analyze the need for change in an organization.
CO3: Analyze the tools and techniques available to implement changes in an organization.
CO4: Evaluate various models of change to manage an organization in changing environment.
CO5: Design a plan for Organization Change Management.

Assessment Details

Continuous Internal Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools (AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Change Management and Organisational Development	Ratan Raina	SAGE Texts	2018
2	Organisational Change- An Action-Oriented Toolkit	Gene Deszca, Cynthia Ingols, Tupper F. Cawsey	SAGE Publications, Inc	2019
3	Organisation Development: The process of Leading Organisational Change	Donald L. Anderson	Sage Publication India Pvt. Ltd.	2/e, 2012
Reference Books				
1	Organisation Development	Donald L. Anderson	SAGE South Asia	2013
2	Toolkit for Organisational Change	T. F. Cawsey, Gene Deszca	SAGE Text	2007
3	Organisation Development and Organisational Change	Donald L. Anderson and Tupper F. Cawsey	SAGE Publications	1/e, 2014

Semester: III

Course Name: Learning and Development

Course Code	**21MBAHR304**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:
1. Basic knowledge on learning practices
2. Basic knowledge about training needs
3. Familiarize with various training programs

Module – 1 Introduction to Learning 8 Hours

Learning: Meaning and significance, The Forces Influencing Working and Learning, classification of learning capabilities, learning theories- Reinforcement Theory, Social Learning Theory, Goal Theories, Expectancy Theory, Adult Learning Theory, pedagogy and andragogy; The basic principles of learning, The Learning Process , Mental and Physical Processes, The Learning Cycle.
Teaching-Learning Process:
Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars **Skill Enrichment Exercise:** Study the importance of learning from employees of various organizations

Module – 2 Training Strategies and Designing Training 8Hours

Strategic Training and development Process, Training needs in different strategies, Models of Training Department. Training needs Assessment, Reasons for planned training. Designing the training program, developing the group and the climate, Trainers and training styles, evaluating training and Follow-on support.
Teaching-Learning Process:
Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars **Skill Enrichment Exercise:** Identify the training strategies conducted in organizations

Module – 3 Training methods 8 Hours

Traditional methods- Presentation methods, Hands-on methods, Group Building Methods, e-learning and use of technology in training- Technology influence on training and learning, Technology and multimedia, computer- based training, 360 degree training, Immersive Training, developing effective online learning, blended learning, mobile technology and training methods, technologies for training Administration, Learning Management Systems (LMSs), Choosing New Technology Training Methods.
Teaching-Learning Process:
Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars **Skill Enrichment Exercise:** Study on the recent training methods adopted by

organizations

Module – 4 Training Evaluations 8 Hours

Meaning, Reasons for Evaluating Training and significance of training evaluation, Donald Kirkpatrick's Evaluation Model, Return on investment in Training, Types of Evaluation Designs, Considerations in Choosing an Evaluation Design, data collection for training evaluation, Threats to Validity, Determining Costs, Evaluation Practices in different organizations.

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars
Skill Enrichment Exercise: Analysis on evaluation practices in different organizations

Module – 5 Contemporary Issues in Training and Development 8 Hours

Career Management: Need, Increased Use of New Technologies for Learning, Increased Demand for Learning for Virtual Work Arrangements, Increased Use of Training Partnerships & Outsourcing Training. Orientation training, diversity training, sexual harassment training, team-training, cross functional teams, cross cultural training, training for talent management and competency mapping. Career Management: A Model of Career Development (Career Stages)

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars
Skill Enrichment Exercise: Study on the latest technologies used for training employees

Course Outcomes:
CO1: Apply the fundamentals of learning theories in training programs in organization.
CO2: Analyze the training strategies and need assessment in organization.
CO3: Design and implement various contemporary methods of training and development.
CO4: Evaluate training evaluation practices in different organizations.
CO5: Create various career management systems using new technologies in achieving organizational goals.

Assessment Details

CIE:

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Effective Training	P Nick and Blanchard	Pearson Education/PHI	2nd Edition, 2005
2	Training & Development	Dr.B. Janakiraman	Biztantra/Wiley Dreamtech	2005
3	Employee Training & Development	Noe A Raymond	McGraw Hill Publication	2e,2011
4	Management Training and Development	Gupta B.L	Vrinda Publications	1st Edition,2011
5	Training and Development Methods	Dr. Rishipal	S. Chand	1st Edition, 2011
Reference Books				
1	Effective HR Training Development Strategy	Ratan Reddy	Pearson	4e,2012
2	Training for Development	Rolf Lynton, Uday Pareek	Sage Publication	2012
3	Training and Development	G. Pandu Naik	Excel Books	2011.

Semester: III

Course Name: Employee Relations & Labour Laws

Course Code	**21MBAHR305**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

1. Knowledge on Basic concepts of HR,
2. Importance of Labour Laws in the workplace,
3. Knowledge on different types of issues at workplace environments,

Module – 1 Fundamental Aspect of Industrial Relations 8 hours

Introduction, Nature of Industrial Relations, Approaches to Industrial Relations, Trade Unions: The Participants of Industrial Relation Activities, State and Employer/Management. The Participants of Industrial Relation Activities; Evolution of Labour Legislation in India **-** History of Labour Legislation in India, Objectives of Labour Legislation, Types of Labour Legislations in India, Constitutional Provisions for the Protection of Labour Workforce in India, Rights of Woman Workers; The Present Labour Laws and Codes

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars

Skill Enrichment Exercise: influence of Trade unions on Management decision making

Module - 2 Factories Act, 1948 8 Hours

Introduction, Objectives, Scope and Important Definitions, Approval, Licensing and Registration of Factories, Health and Safety of Workers, Provisions Related to Working Conditions, Hazardous Processes, Employee Welfare and Working Hours, Employment of Young Persons and Women, Annual Leaves with Wages, Penalties and Contingence of Offences

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars

Skill Enrichment Exercise: Application of Factories Act 1948 on different Industries

Module – 3 Social Security Act 8Hours

The Employees' Compensation Act, 1923

Introduction, Objectives, Scope and Important Definitions of the Act, Eligibility, Rules for Workmen's Compensation, Amount and Distribution of Compensation, Notice, Claims and Other Important Provisions, Enforcement of Act and Provisions for Penalty

The Employees' State Insurance Act, 1948

Introduction, Objectives, Scope and Important Definitions, Administration of the Act, Finance and Audit, Contribution, Benefits, Obligations of Employers under the Act, Adjudication of Disputes, Claims and Penalties, Exemptions

The Maternity Benefit Act, 1961

Introduction, Objectives, Scope and Important Definitions, Provisions Related to Maternity, Benefits, Enforcement of the Act, Penalties and Offences, Miscellaneous Provisions of the Act

The Employees' Provident Funds and Miscellaneous Provisions Act, 1952

Introduction, Objectives, Scope and Important Definitions, Administration of the Schemes under the Act, Administration of the Act,

The Payment of Gratuity Act, 1972

Introduction, Objectives, Scope and Important Definitions, Payment and Forfeiture of Gratuity and Exemption, Compulsory Insurance and Protection of Gratuity, Determination and Recovery of Gratuity, Enforcement of the Act, Penalties and Offences.

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars

Skill Enrichment Exercise: Discussion on Implementation of Social security Act in Indian companies

Module – 4 Wages Act **8Hours**

The Payment of Wages Act, 1936

Introduction, Objectives, Scope and Important Definitions, Provisions for Payment of Wages, Deductions from Wages, Enforcement of the Act, Penalties and Offences, Miscellaneous, Provisions of the Act

The Minimum Wages Act, 1948

Introduction, Objectives, Scope and Important Definitions, Fixation and Revision of Wages, Payment of Minimum Wages, Enforcement of the Act, Penalties and Offences, Miscellaneous, Provisions of the Act

The Payment of Bonus Act, 1965

Introduction, Objectives, Scope and Important Definitions of the Act, Eligibility, Disqualification and Amount of Bonus, Calculation of Bonus, Special and Miscellaneous Provisions, Dispute, Penalties and Offences

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminar

Skill Enrichment Exercise: Analyzing compensation plans of different Industries

Module – 5 Regulating Employer-Employee Relations Act 8Hours

The Industrial Disputes Act, 1947
Introduction, Objectives, Scope and Important Definitions, Procedure for Settlement of Industrial Disputes and Authorities under the Act,
The Industrial Employment (Standing Orders) Act, 1946
Introduction, Objectives, Scope and Important Definitions of the Act, Procedure for Certification of Standing Orders, Other Provisions Relating to Standing Orders, Miscellaneous Provisions of the Act, Penalties and Offences
The Trade Unions Act, 1926: Introduction, Objectives, Scope and Important Definitions

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars
Skill Enrichment Exercise: Discussions on affects of Employees-Employer Relations on Organization's performance

Course Outcomes:
CO1: Acquire conceptual knowledge of Industrial relations and labour laws followed within industries.
CO2: Develop the greater understanding of IR concepts and its application in solving various issues in IR.
CO3: Analyze IR and labour laws concepts in various industries in India.
CO4: Interprete the application of Labour Legislations
CO5: Develop practical experience related to labour legislations in India across various sectors

Assessment Details

CIE:

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

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- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.

- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Industrial Relations and Labour Laws for Managers	Parul Gupta	Sage Publication India Pvt. Ltd	2019
2	The SAGE Handbook of Industrial Relations	Paul Blyton, Edmund Heery, Nicolas Bacon, Jack Fiorito	SAGE Publications	2008
3	Labour and Industrial Laws	P. K. PADHI	Prentice Hall India Pvt., Limited	2017
Reference Books				
1	Bare Acts, Ministry of Labour	GOI	GOI	2019
2	The Idea of Labour Law	Guy Davidov, Brian Langille	The Oxford University Press	2011
3	Labour and Industrial Laws	PADHI, P. K	PHI Learning Pvt. Ltd	2019

SEMESTER: III

Course Name: Human Resource Audit

Course Code	**21MBAHR306**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

1. Basic Knowledge of HR concepts
2. Importance of Audit function in the organizations
3. Importance of Organization Development

Module – 1 Introduction 8hours

HRD-Strategies and Systems; HR as Strategic Partner; HR Policies and Practices , Understanding HR system, Role of HR Manager in HRD , Elements of good HRD , Identifying HR competencies Meaning and Importance of HR Auditing, Benefits, Scope of Human Resource Audit ,Components of HRD Audit

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars
Skill Enrichment Exercise: Analyzing the components of HR Audit in different Industries

Module - 2 Conceptual understanding of HR Audit 8 Hours

Conceptualizing of Human Resource Audit, , The Audit system, Advantages and challenges, Identifying the Human Resource Audit Goal, Defining the Audit Team, Approaches to measuring HR Audit, Benefits, Competencies required for HR conducting HR Audit, HR Audit strategies, Strategic Alignment of HR audit

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars
Skill Enrichment Exercise: Discussion on Goals of HR audits and its strategic alignment of various companies

Module – 3 HR Audit Process 8 Hours

Methodology of HR Audit: Introduction, Conducting a Human Resource Audit, Preliminary Steps, Planning questions; Interview; Observation; Questionnaire; Collecting Audit data; Analyzing and interpreting data; Assessing organization ability to change; Credibility building of HR Dept; Internal - External Audit , Issues in HR Audit, Post Audit steps-Action Plan; HR Audit Report: Purpose, Report Design – Preparation of report , Use of HR Audit report for business improvement ,

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars
Skill Enrichment Exercise: Reviewing articles on HR audit to identify the components for developing questionnaire for audit process

Module – 4 Areas of HR Audit & HR Score Card 8 Hours

Audit of HR Planning; Training and Development; Industrial & Employee Relations;
HR Audit as Intervention: Introduction, Effectiveness of Human Resource Development Audit as an Intervention, Human Resource Audit and Business Linkages;
HR Scorecard: Introduction, Components of HR Scorecard, Framework of HR Scorecard, Usage of HR Score card in HR auditing, Human Resource Scorecard Design, Measuring Human Resource Effectiveness through HR Score card, Balanced Scorecard

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars
Skill Enrichment Exercise: Application of HR scorecard in organizations

Module – 5 HR Audit for legal compliance and safe Business practices 8 Hours

Using scorecard approach in formulating workplace policies; Recruitment and Selection: Formulating FIR Audit for Start-up companies; HR Audit in practice: Cases in manufacturing industry, Service industry.

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars
Skill Enrichment Exercise: Analyzing case studies on HR audit in different Industries

Course Outcomes:
CO1: To Gain conceptual knowledge and practical experience in understanding the HR Audit.
CO2: Analyze the strategic approaches to HR Audit aspects
CO3: Develop knowledge and apply the concepts of HR Audit in the organization
CO4: Elaborate better understanding of HR Audit concepts, policies and practices applied in the organization
CO5: Critically analyze the impact of HR Audit on the contemporary issues in the organization

Assessment Details

CIE:

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20

	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	HRD Audit: Evaluating the Human Resource Function for Business Improvement	TV Rao	Sage Response	2/e, 2014
2	HR Audit , Durdana Ovais	Rajni Gyanchandani	Everest Publishing House	2017
3	The HR Scorecard: Linking People, Strategy and Performance		Harvard Business Review Press	1/e, 2001
	Human Resource Function:Audit	Peter Reiley	ABE Books	1999
Reference Books				
1	Auditing your Human Resource Department	John Mcconnell	AMACOM	2/e, 2011
2	HRD Score Card 2500: Based on HRD Audit , ,	, TV Rao	Sage Response	1/e, 2005
3	7 Easy Steps to Conduct a Human Resources Audit and Protect Your Company!	Vanessa Nelson	Lulu Publication	2016

GUIDELINES FOR INTERNSHIP 21MBAIN307
(BETWEEN 2ND AND 3RD SEMESTER MBA)

INTERNSHIP			
Course Code	**21MBAIN307**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**0:0:8**	**SEE Marks**	**50**
Credits	**04**	**Exam Hours**	**00**

COURSE OBJECTIVE:

1. To expose the students to understand the working culture of the organization and apply theoretical concepts in real life situation at the work place for various functions of the organization.
2. To build the ability in the student to identify the challenges faced by various organizations.
3. To make them understand the workflow models and the structure of the organization.
4. To help them implement various strategic marketing models on the organizational operations.
5. To gain the knowledge of overall organizational strategic & financial performance in tandem with societal benefits.

STRUCTURE:

The Internship shall consist of study of an organization for 4 credits for 6 weeks.

GENERAL GUIDELINES:

- The Internship shall be for a period of 6 weeks immediately after the completion of 2^{nd} Semester Examinations but before the commencement of the 3rd semester classes. Copies of the Internship report should be sent to the concerned COE Office, Ballari Institute of Technology & Management, Ballari with intimation to the COE.
- The Course code of the Internship shall be 21MBAIN307 and shall be compulsory for allthe students.
- No two students of an institute shall work on the same organization.
- The student shall seek the guidance of the internal guide on a continuous basis, and the guide shall give a certificate to the effect that the candidate has worked satisfactorily under his/her guidance. Student need to identify an external guide (Working in theorganization) and seek guidance from him/her.

Submission of Report: Students shall submit one hardcopy of the report to the college with hard bound color of royal blue and a softcopy in PDF file (Un-editable Format).

Evaluation:
Internal evaluation will be done by the internal guide.

Viva-Voce/Presentation: A viva-voce examination shall be conducted at the respective institution where a student is expected to give a presentation of his/ her work. The viva –voce examination will be conducted by the respective HOD or Senior Professor or Internal Guide of the department and an external evaluator drawn from industry. In case of non-availability of industry professional, a senior professor or a faculty with more than 10years of experience may be invited to conduct the viva-voce examination. Internship carries 100 marks consisting of 50 marks for Internship report (evaluated by internal guide) and 50 marks for viva-voce examination (evaluated by guide & external examiner).

Contents of the Internship Report:

- Cover page
- Certificate from the Organization (scanned copy)
- Certificate from the guide, HOD and Head of the Institution (scanned copy)indicating bonafide performance of Internship by the student.
- Declaration by the student (scanned copy)
- Acknowledgement
- Table of contents
- List of tables and graphs

Executive summary
Chapter1: Introduction about the Organization & Industry.
Chapter2: Organization Profile

I. Background,
II. Nature of business,
III. Vision mission, quality policy
IV. Workflow model
V. Product/service profile
VI. Ownership pattern
VII. Achievements/awards if any
VIII. Future growth and prospects

Chapter3: Mckensy's7S framework and Porter's Five Force Model with special reference toOrganization under study.
Chapter4: SWOT Analysis
Chapter5: Analysis of financial statements**Chapter 6:** Learning Experience
Bibliography

Annexure relevant to the Internship such as figures, graphs, photographs, Financial statements etc.,

Format of the Internship:

1. Report shall be prepared using the word processor viz., MS Word.
2. Times New Roman font sized 12
3. page layout of A4 size with 1” margin all sides (1.5” on left side due to binding) and1.5line spacing
4. The Internship report shall not exceed 60 pages

Rubrics for Internship 21MBAIN307 Marks

Sl. No		Particulars	Marks
1	CIE	Assessment by the Guide-Interaction with the student	25
2	CIE	Report Evaluation by the Guide	25
3	SEE	Viva-Voce Examination to be conducted by the Guide and an External examiner from the Industry/Institute	50
		Total	100

Ballari Institute of Technology & Management, Ballari
(Autonomous Under VTU)

Mark sheet for Viva-Voce Examination (SEE)
Name of the Institution
Name of the Department

Course Code: 21MBAIN307
Course Title: Internship

Sl.No	Aspects	Marks
1	Introduction	5
2	Understanding the Industry	5
3	Understanding the Corporate Functions/Company profile	5
4	Mckensy's 7S framework and Porter's Five Force Model	10
5	SWOT/SWOC analysis justification	10
6	Financial statement analysis	10
7	Learning experience	5
	Total	50

Marks Sheet for Viva Voce examination

SL No	USN	1	2	3	4	5	6	7	Total
1									
2									
3									
4									
5									
	Total								50

Signature of Internal Examiner
Name and Designation with affiliation

Signature of External Examiner
Name and Designation with affiliation

Semester: III

Course Name: Aptitude Skill (Mandatory Non-Credit Course)

Course Code	**21MBAAT308**	**CIE Marks**	**100**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**-**
Credits	**---**	**Exam Hours**	**01**
Total Hours of Pedagogy	**30**	**Max Marks**	**100**

Pre-requisites:

- **Knowledge of Basics in Numerical**
- **Basics of Verbal and non-verbal Reasoning**
- **Basics of English Grammar**

Module – 1: Numerical Ability **6 Hours**

Squares and square roots, Cubes and cube roots, Ratio and proportion, Percentages, Averages, Profit and Loss, SI, CI10
Teaching-Learning Process:
Pedagogy: Lecture Method

Module – 2 Time Based and Permutation Based Problem Solving **6 Hours**

Time and distance, Trains, Boats and streams, Time and work, Pipes and cisterns, Permutations, Combinations, Probability
Teaching-Learning Process:
Pedagogy: Lecture Method

Module – 3Analytical & Verbal Reasoning **6 Hours**

Clocks & Calendars, Number series, Letter series, Directions, Coding and decoding, Blood relations, Venn diagrams, Classification, Syllogism, Analogy
Teaching-Learning Process
Pedagogy: Lecture Method

Module – 4 Data Analysis **6 Hours**

Data interpretation, Data sufficiency, Mensuration, Grammar for spotting errors and sentence correction, Concepts for Sentence completion and passage completion
Teaching-Learning Process:
Pedagogy: Lecture Method

Module – 5 Communicative English **6 Hours**

Vocabulary for Synonyms, Antonyms and one-word substitutions, Effective structures (for e-mail writing and essay writing), Reading comprehension and sentence rearrangement / Para jumbles.
Teaching-Learning Process:
Pedagogy: Lecture Method

Course Outcomes: At the end of the course the student will be able to:

At the end of the course the students will…
CO1. Apply the skills related with Numerical Ability
CO2. Able to analysis for emulate with Time based, Permutation
CO3. Apply acquainted with Analytical and verbal reasoning
CO4. Analyse with the data
CO5. Ability to profound with communication English

Assessment Details

Continuous Internal Evaluation(CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3	60%	60
(ii)	Alternate Assessment Tools(AAT) (B)	3	40%	40
	Total Marks			100

***There is No SEE exam**

IV Semester

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT - BALLARI
4th Semester Scheme (Course with Dual Specialization)
(Effective from the academic year 2021-22)
Data Analytics Specialization

SN	Course Code	Course Name	Teaching hours per week			Marks for		Total Marks	Credits
			Lecture	Practical component	Total	CIE	SEE		
1	21MBADA401	R Programming For Managers	2	2	4	50	50	100	3
2	21MBADA402	Business Intelligence	2	2	4	50	50	100	3
3	21MBADA403	Enterprise Resource Planning	2	2	4	50	50	100	3
4	21MBADA404	Peoples Analytics	2	2	4	50	50	100	3
5	21MBADA405	Project Management	2	2	4	50	50	100	3
6	21MBADA406	Corporate Social and Web Analytics	2	2	4	50	50	100	3
7	21MBAPR407	Project Work	0	16	16	50	50	100	08
		Total	12	12	24	350	350	700	26

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT - BALLARI
4th Semester Scheme (Course with Dual Specialization)
(Effective from the academic year 2021-22)
Logistics & Supply Chain Management Specialization

SN	Course Code	Course Name	Teaching hours per week			Marks for		Total Marks	Credits
			Lecture	Practical component	Total	CIE	SEE		
1	21MBALS401	Port and Airport Management forLogistics	2	2	4	50	50	100	3
2	21MBALS402	Global Supply Chain Management	2	2	4	50	50	100	3
3	21MBALS403	Export Import Management	2	2	4	50	50	100	3
4	21MBALS404	International Logistics Management	2	2	4	50	50	100	3
5	21MBALS405	Containerization and MultimodalTransportation Management	2	2	4	50	50	100	3
6	21MBALS406	Supply Chain Information System	2	2	4	50	50	100	3
7	21MBAPR407	Project Work	0	16	16	50	50	100	08
		Total	12	12	24	350	350	700	26

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT - BALLARI 4th Semester Scheme (Course with Dual Specialization) (Effective from the academic year 2021-22) Finance Specialization									
SN	Course Code	Course Name	Teaching hours per week			Marks for		Total Marks	Credits
			Lecture	Practical component	Total	CIE	SEE		
1	21MBAFM401	Risk Management & Insurance	2	2	4	50	50	100	3
2	21MBAFM402	Wealth Management	2	2	4	50	50	100	3
3	21MBAFM403	Indirect Taxation	2	2	4	50	50	100	3
4	21MBAFM404	Financial Derivatives	2	2	4	50	50	100	3
5	21MBAFM405	Behavioral Finance	2	2	4	50	50	100	3
6	21MBAFM406	International Financial Management	2	2	4	50	50	100	3
7	21MBAPR407	Project Work	0	16	16	50	50	100	08
		Total	12	12	24	350	350	700	26

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT - BALLARI 4th Semester Scheme (Course with Dual Specialization) (Effective from the academic year 2021-22) Marketing Specialization									
SN	Course Code	Course Name	Teaching hours per week			Marks for		Total Marks	Credits
			Lecture	Practical component	Total	CIE	SEE		
1	21MBAMM401	Sales Management	2	2	4	50	50	100	3
2	21MBAMM402	Integrated Marketing Communication & Advertising	2	2	4	50	50	100	3
3	21MBAMM403	Digital & Social Media Marketing	2	2	4	50	50	100	3
4	21MBAMM404	Strategic Brand Management	2	2	4	50	50	100	3
5	21MBAMM405	Rural Marketing	2	2	4	50	50	100	3
6	21MBAMM406	International Marketing Management	2	2	4	50	50	100	3
7	21MBAPR407	Project Work	0	16	16	50	50	100	08
		Total	12	12	24	350	350	700	26

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT - BALLARI 4th Semester Scheme (Course with Dual Specialization) (Effective from the academic year 2021-22) Human Resource Specialization									
SN	Course Code	Course Name	Teaching hours per week			Marks for		Total Marks	Credits
			Lecture	Practical component	Total	CIE	SEE		
1	21MBAHR401	Leadership & Building Organization	2	2	4	50	50	100	3
2	21MBAHR402	Personal Growth and Interpersonal Effectiveness	2	2	4	50	50	100	3
3	21MBAHR403	International Human Resource Management	2	2	4	50	50	100	3
4	21MBAHR404	Public Relations	2	2	4	50	50	100	3
5	21MBAHR405	Compensation Management &Reward system	2	2	4	50	50	100	3
6	21MBAHR406	Talent Management	2	2	4	50	50	100	3
7	21MBAPR407	Project Work	0	16	16	50	50	100	08
		Total	12	12	24	350	350	700	26

Semester: IV

Course Name: R Programming For Managers

Course Code	**21MBADA401**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**

Module – 1 Hadoop 5 Hours

Hadoop Distributed File System Basics, Running example programs and benchmarks, Hadoop MapReduce Framework, MapReduce programming.
Teaching-Learning Process:
Pedagogy: Lab and Lecture Method.

Module –2 Business Intelligence 5 Hours

Business Intelligence concepts and applications, Data warehousing, Data Mining, Data Visualization.
Teaching-Learning Process:
Pedagogy: Lab and Lecture Method.

Module – 3 Data Analytics 5 Hours

Introduction to Data Analytics, Introduction to R programming.
Teaching-Learning Process:
Pedagogy: Lab and Lecture Method.

Module – 4 Data Manipulation 5 Hours

Data Manipulation in R, data import techniques in R.
Teaching-Learning Process:
Pedagogy: Lab and Lecture Method.

Module – 5 Data Visualization 5 Hours

Exploratory Data Analysis, data Visualization in R.
Teaching-Learning Process:
Pedagogy: Lab and Lecture Method.

Course Outcomes: At the end of the course the student will be able to:
CO1: Illustrate the basics of hadoop file system.
CO2: Demonstrate the importance of data mining techniques in business objectives.
CO3: Analyse the importance of business analytics and its applications using R programming.
CO4: Interpret data manipulation techniques using R programming.
CO5: Apply data visualization techniques in business objectives.

Assessment Details

Continuous Internal Evaluation (CIE):

	Components	Number	Weightage	Max.

				Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
		Textbooks		
1	"Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem"	Douglas Eadline	Pearson..	1st Edition,
2	Data Analytics	Anil Maheshwari	McGraw Hill	1st Edition, 2017
		Reference Books		
1	Hadoop: The Definitive Guide	Tom White	O'Reilly Media	4th Edition.
2	"Hadoop Operations: A Guide for Developers and Administrators"	Eric Sammer	O'Reilly Media	1st Edition

Semester: IV

Course Name: Business Intelligence

Course Code	**21MBADA402**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**

Module – 1 Business Intelligence From Business Side 8 Hours

Business Intelligence by other names. How Business Intelligence provides business value. The Business Intelligence market. Operational and source systems. Data transfer from operational to data warehouse. The data warehouse, data warehouse tables. The data warehouse technology platforms. Best practices for successful business intelligence
Teaching-Learning Process:
Pedagogy: Lab and Lecture Method.

Module – 2 The Business Intelligence front-end 8 Hours

Business query and reporting. Production reporting. Online Analytical Processing (OLAP) Microsoft office Dashboards, Scoreboards, Performance Management, Analytic applications, Emerging BI modules. Success and business impact. How to measure Success? Return on Investment.
Teaching-Learning Process:
Pedagogy: Lab and Lecture Method.

Module – 3 The LOFT effect 8 Hours

The LOFT effect. Role of Luck. Opportunity. Frustration. Threat. The role of time. If there is no LOFT effect, Is successful BI still possible? Best practices for successful business intelligence. D is for data. Data quality. Successful data architectures. Master data management (MDM). Right time data. Data quality’s chicken and egg.
Teaching-Learning Process:
Pedagogy: Lab and Lecture Method.

Module – 4 The Right BI tool for the right user 8 Hours

The importance of BI tools. The role of BI standardization. The Right BI tool for the right user. The most successful BI module. Best practices for successful Business intelligence.
Teaching-Learning Process:
Pedagogy: Lab and Lecture Method.

Module – 5 Secrets to Success & the future of Business Intelligence 8 Hours

The role of Culture. Promoting your BI capabilities. Training. A picture is worth a thousand numbers. Emerging technologies. Predicting future. BI search & Text Analytics. Advanced visualization. Rich Report lets. The Future beyond technology. Words of wisdom.
Teaching-Learning Process:

Pedagogy: Lab and Lecture Method.

Course Outcomes: At the end of the course the student will be able to:
CO1: Apply various concepts of BI to provide solutions to the business.
CO2: Demonstrate various analytical tools on the data to solve business problems.
CO3: Demonstrate the best practices for successful implementation of BI.
CO4: Choose appropriate BI tool to solve the business problems.
CO5: Elucidate the BI capabilities to perform analysis and reporting of data.

Assessment Details

Continuous Internal Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Successful business Intelligence: secrets to making BI a killer app	Cindi Howson	Mc Grew hill	2007
Reference Books				
1	Business Intelligence Road Map	Larissa T.Moss Shaku Atre	Addison Wesley	2003

Semester: IV

Course Name: Enterprise Resource Planning

Course Code	**21MBADA403**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**

Module – 1 ERP – A Curtain Raiser 8 Hours

An Overview, Accommodating variety, Integrated Management Information, Seamless Integration, Supply Chain Management, Resource Management, Integrated Data Model, Scope, Technology, Benefits of ERP. Evolution, ERP Revisited, ERP & the Modern Enterprise, Problems.

Teaching-Learning Process:

Pedagogy: Lab and Lecture Method.

Module –2 Business Engineering & ERP 8 Hours

An Overview, What is Business Engineering, Significance of Business Engineering, Principles of Business Engineering, BPR, ERP and IT, Business Engineering with Information Technology, ERP & Management Concerns, Business Modelling for ERP-Building the Business Model, Problems.

Teaching-Learning Process:

Pedagogy: Lab and Lecture Method.

Module – 3 ERP Implementation 8 Hours

Role of Consultants, Vendors & Users, Customization, Precautions, ERP Post Implementation Options, ERP Implementation Methodology, Guidelines for ERP Implementation, Problems.

Teaching-Learning Process:

Pedagogy: Lab and Lecture Method.

Module – 4 ERP Domain 8 Hours

The ERP Domain- MFG/PRO, IFS/ Avalon- Industrial & Financial Systems, Baan IV, SAP 82, SAP R/3 Applications, Example of an Indian ERP Package, The Arrival of ERP III, Problems.

Teaching-Learning Process:

Pedagogy: Lab and Lecture Method.

Module – 5 ERP and Competitive Advantage 8 Hours

ERP and the Competitive Strategy, Problems.
Marketing of ERP- Market Dynamics and Competitive Strategy, Problems.

Teaching-Learning Process:

Pedagogy: Lab and Lecture Method.

Course Outcomes: At the end of the course the student will be able to:
CO1: Ability to understand and analyse various components of ERP
CO2: Develop ERP model to solve business problems.
CO3: Apply ERP implementation techniques to create solutions for business.
CO4: Demonstrate various packages related to different areas of business.
CO5: Analyse the strategic options for ERP identification and adoption.

Assessment Details

Continuous Internal Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
		Textbooks		
1	Enterprise Resource Planning	Vinod Kumar Garg, N.K Venkitakrishna n	Prentice hall of India.	2nd edition 2004.

Semester: IV

Course Name: Peoples Analytics

Course Code	**21MBADA404**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**

Pre-requisites:

1. Analytical skills
2. Statistical Proficiency
3. Good Decision Making skills
4. Logical Reasoning
5. Knowledge on HR concepts

Module-1 Introduction to Peoples Analytics 8 Hours

Introduction to People Management, Application of Analytics in Managing HR, Important definitions, Genesis of People analytics, importance , benefits and , skills needed for people analytics, future of people analytics , alignment of HR Analytics with business goals and strategy application of People Analytics to critical HRM functions for decision making, People Analytics framework and models.

Teaching-Learning Process:

Pedagogy: Lab and Lecture Method.

Module – 2 Peoples Analytics and Data 8 Hours

HR Data and Data Quality, HR Data Collection, Big Data for HR, Transforming HR Data in to HR Information, Process of Data Collection for HR Analytics, Data collection for effective HR Measurement, Levels of HR Analysis, Meaning of HR value Proposition, Measuring HR value proposition with People Analytics: Value proposition and HR decisions, Performing Root cause analysis, Datafication of Human Resources.

Teaching-Learning Process:

Pedagogy: Lab and Lecture Method.

Module – 3 HR Metrics and its Application 8 Hours

HR Metrics: Meaning, Types: Recruitment & Selection Metrics; Training & Development Metrics; Staffing Metrics; usage of Analytics in Performance appraisal , Talent Management & Compensation Management, Expatriate Management, Performance Metrics at Organizational level, HR Dashboards; HR Scorecard.

Teaching-Learning Process:

Pedagogy: Lab and Lecture Method.

Module – 4 Application of Analytics in Data Visualization 8 Hours

Dashboards: Few Key Excel Add-ins/Functions to Help Create Dashboards, Name Range, The Developer Tab, Form Controls, Important Excel Formulas Useful for Creating Dashboards, VLOOKUP, INDEX, SUMIF, AVERAGEIF and COUNTIF.
Introduction of Data visualization tools such as Tableau, Ploty, Click view and Fusion Charts.

Application of Tableau in HR Data Visualization: Tablueau Desktop, Tableau for Academicians, Menu options, Toolbar Description, Dimensions & Measures, Creating Dashboards in Tableau.
Teaching-Learning Process:
Pedagogy: Lab and Lecture Method.

Module – 5 HR Predictive Modeling 8 Hours

Correlation & Regression: Correlation Analysis, Simple Linear & Multiple Regression Analysis, Interaction Effects. Comparison of Means and ANOVA, One-Sample T-test, Null and Alternate Hypotheses, Paired Sample T-Test, Independent-Sample T-Test, Analysis of Variance, Factor Analysis; Cluster Analysis. Software for Statistical Analysis: MS-Excel, IBM- SPSS, IBM-AMOS, SAS, and R programming **Case study**: HR Predictive Modeling; Predictive Analytics Tools & Techniques, Conducting Hypotheses testing using Statistical Software.
Teaching-Learning Process:
Pedagogy: Lab and Lecture Method.

Course Outcomes: At the end of the course the student will be able to:
CO1: Demonstrate the data driven decisions using statistical techniques
CO2: Interpret the basic analytical frameworks to aid strategic business decisions.
CO3: Analyze the people data to facilitate soft skill decision about hiring & talent development.
CO4: Make use of data analysis & visualization tools to deliver informed decision.
CO5: Identify potential business opportunities and risks using data patterns.

Assessment Details

CIE:

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
		Textbooks		
1	HR Analytics- Connecting Data and Theory	Rama Shankar Yadav Sunil Maheshwari	WILEY, India	2021
2	Practical Applications of HR Analytics 2019	Pratyush, Banerjee; Jatin Pandey; Manish Gupta	SAGE Texts, India	2019
3	HR Analytics- Understanding Theories and Applications	Bhattacharya, Dipak Kumar	SAGE Texts, India	2017
		Reference Books		
1	Applying Advanced Analytics to HR Management Decisions: Methods for Selection, Developing Incentives and Improving Collaboration	Sesil James, C	Pearson, New Jersey	2017
2	Predictive Analytics- Mastering the HR Matrix,	Martin Edwards and Kirsten Edwards,	Kogan Page,	2019
3	Fundamentals of HR Analytics: A Manual on Becoming HR Analytical	Fermin Diez, Mark Bussin, Venessa Lee, ,	Emerald Publishing Limited	2019

Semester: IV

Course Name: Project Management

Course Code	**21MBADA405**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**

Module – 1 Introduction to Project Management 8 Hours

What is Project Management? Projects and Strategic Planning Relationship Between Project Management, Operations Management, and Organizational Strategy. Operations and Project Management. Organizations and Project Management. Role of the Project Manager. Responsibilities and Competencies of the Project Manager. Interpersonal Skills of a Project Manager.
Teaching-Learning Process:
Pedagogy: Lab and Lecture Method.

Module – 2 Organization Influence & project Life cycle 8 Hours

Organizational Cultures and Styles. Organizational Structures. Composition of Project Teams. Project Life Cycle: Characteristics of the Project Life Cycle. Project Phases. Project Management Process Groups. Planning Process Group. Executing Process Group. Monitoring and Controlling Process Group Closing Process Group.
Teaching-Learning Process:
Pedagogy: Lab and Lecture Method.

Module – 3 Project Time Management 8 Hours

Schedule Management: Inputs, Tools and Techniques & output. Define activities: Inputs, Tools and Techniques & output. Sequence Activities: Inputs, Tools and Techniques & output. Estimate Activity resources: Inputs, Tools and Techniques & output. Estimate Activity Duration: Inputs, Tools and Techniques & output. Develop Schedule: Inputs, Tools and Techniques & output. Control Schedule: Inputs, Tools and Techniques & output.
Teaching-Learning Process:
Pedagogy: Lab and Lecture Method.

Module – 4 Project Cost & Quality Management 8 Hours

Cost Management: Inputs, Tools and Techniques & output. Estimate Cost: Inputs, Tools and Techniques & output. Determine Budget: Inputs, Tools and Techniques & output. Control Costs: Inputs, Tools and Techniques & output. Project Quality Management: Inputs, Tools and Techniques & output. Performance Quality Assurance: Inputs, Tools and Techniques & output. Control Quality: Inputs, Tools and Techniques & output.
Teaching-Learning Process:
Pedagogy: Lab and Lecture Method.

Module – 5 Project Stakeholder Management 8 Hours

Identify Stakeholders: Inputs, Tools and Techniques & output. Plan Stakeholders Management: Inputs, Tools and Techniques & output. Manage Stakeholders Engagement: Inputs, Tools and Techniques & output. Control Stakeholders engagement: Inputs, Tools and Techniques & output.
Teaching-Learning Process:
Pedagogy: Lab and Lecture Method.

Course Outcomes: At the end of the course the student will be able to:
CO1: Define the high professional standards of practice for project manager
CO2: Identify the key activities in the project life cycle.
CO3: Explore appropriate methods to initiate, plan and execute projects
CO4: Examine the scope, time, cost and quality of projects.
CO5: Analyze the stake holder expectations and engagement using suitable techniques.

Assessment Details

Continuous Internal Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
		Textbooks		
1	A Guide to the Project Management Body of Knowledge		Project Management Institute	Global Edition 5-7

Semester: IV

Course Name: Corporate Social and Web Analytics

Course Code	**21MBADA406**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**

Module – 1 Social Media Data 8 Hours

Foundation for Analytics, A Look into the Evolution of Data and the Digital Gap, Social Media Data Sources: Offline and Online, Defining Social Media Data, Data Sources in Social Media Channels, Estimated vs. Factual Data Sources, Social Media Network Support of Data Collection, API: Application Programming Interface.

From data to insights: Shaping Data to Work for Us, Creating a Plan to Shape Data into Insights A Glimpse into the Analysis: The Process of Comparison.

Analytics in Social Media: Defining a Very Broad Term, Types of Analytics in Social Media: Analytics, Listening, Advertising Analytics, Analytics from CMS and CRM

Dedicated Vs. Hybrid tools: What Are They? Which Are Best?, The Advantages of Dedicated Tools, The disadvantages of Dedicated Tools. Data Integration Tools.

Teaching-Learning Process:

Pedagogy: Lab and Lecture Method.

Module –2 The Analytics Process 8 Hours

Elements to Shape Data Insights, The Analysis Cycle: Time Periods as the First Key to Comparison. Armando Terribili.

Metrics, dashboards and reports: Metrics- The Basis for Analysis, Metrics and Strategy: Selecting the Best Metrics for the Job. Dashboards-More Than a Collection of Metrics, Dashboard Purpose, Default vs. Custom Dashboards, The Essence of a Good Dashboard, Reports-The Key to Analytics Success, Reporting Approaches, Animation and Effects in Reporting, Reporting with Teams, The Report as a Key to Success.

Teaching-Learning Process:

Pedagogy: Lab and Lecture Method.

Module – 3 Web Analytics: Present and Future 8 Hours

History of Web Analytics, current landscape and challenges, What web analytics should do?

Data Collection: Understanding data landscape, clickstream data, outcomes data, research data, competitive data.

Teaching-Learning Process:

Pedagogy: Lab and Lecture Method.

Module – 4 Overview of Qualitative Analysis 8 Hours

Lab usability testing, Heuristic evaluations, site visits, surveys, focus on customer centricity, solve for business questions, follow the 10/90 rule.

Teaching-Learning Process:

Pedagogy: Lab and Lecture Method.

Module – 5 Web Analytics Fundamentals 8 Hours

Capturing data, selecting your optimal web analytics tool, understanding clickstream data quality, implementing best practices.
Teaching-Learning Process:
Pedagogy: Lab and Lecture Method.

Course Outcomes: At the end of the course the student will be able to:
CO1: Utilize API services to collect data from different social media data sources
CO2: Derive insights from processed data using suitable metrics and reporting methods.
CO3: Explain the role of web analytics within the digital marketing landscape
CO4: Make use of Heuristic evaluation & web intelligence to solve business problems.
CO5: Demonstrate the best practices in web analytics for potential business growth

Assessment Details

Continuous Internal Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
		Textbooks		
1	Social Media Analytics Strategy- Using Data to Optimize Business Performance	Alex Goncalves	Springer Science, New York	2017
2	Web Analytics- An Hour A Day	Avinash Kaushik	Wiley Publications	May 2007

Semester: IV

Course Name: Port and Airport Management for Logistics

Course Code	**21MBALS401**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:
- Basic knowledge of port and airport management.
- Basics of logistics and supply chain.
- Awareness of port and airport services

Module 1 – Port Structure & Airports Shipment **10 Hours**

Port Structure and Functions: Definition - Types and Layout of the Ports – Organizational structure - Fundamental observations. Main functions and features of ports: Infrastructure and connectivity Administrative functions - Operational functions.
Air Ports and Shipment: Ground Handling Agencies - Air Craft - Advantage of Air shipment - Economics of Air Shipment -Sensitive Cargo by Air shipment - Do's and Don'ts in Air Cargo Business.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercises: Study the different ports and airports and mention the different functions and features.

Module 2 – Port Operations & Air Cargo **10 Hours**

Port Operations: Berths and Terminals - Berth Facilities and Equipment - ship Operation – Pre-shipment planning, the stowage plan and on-board stowage - cargo positioning and stowage on the terminal – Developments in cargo/container handling and terminal operation - Safety of cargoOperations - Cargo security: Measuring and evaluating performance and productivity.
Air Cargo: Air Cargo Console - Freighting of Air Cargo - Volume based Calculation of Freight - Weight basedCalculation of Freight - Import Documentation - Export Documentation

Teaching-Learning Process: Students should study the various operations of port and air cargo and prepare a report.

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercises: Student should consider few ports and draft the flow chart of the shipment process.

Module 3 – Port Development & Airway Bills **10 Hours**

Port Development: Phases of port development - Growth in word trade - Changes in growth Development in terminal operation. Shipping technology and port: Ship knowledge Ship development and port development - Port time and ship speed.
Airway Bills - FIATA - IATA - History of IATA - Mission of IATA - Price setting by IATA - Licensing of Agencies.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential

Learning.
Skill Enrichment Exercises: Students should prepare a report on port development strategies with few examples.

Module 4 – Port Administration Owner **10 Hours**

Port Administration Ownership and Management Port ownership structure- Types of port ownership and administration – Organizations concerning ports - Boards governing the ports - Port management development Rise and fall of Ports - information technology in ports. Port ownership in Indian context: Acts governing the Ports in India – Port ownership structure in India.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercises: Live case study on air cargo.

Module 5 – Air Transportation & DG Air Cargo **10 Hours**

Air Transport: Introduction to Air Transport – Air Freight – IATA – Cargo Handling at Goods at Air Port – Information Management of Air Cargo – System and Modules – Distribution of Goods.
DG Cargo by Air - Classification and labeling - Types of Labels according Cargo - Samples of
Labels - Packing and Transportation of DG Goods by Air.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercises: Case study on air transportation and freights.

Course Outcomes: At the end of the course the student will be able to:

CO1: Application of process of Port and Air Management for Logistics operations.
CO2: Analyze the various activities involved in port operations and air cargo for the appropriate shipping of goods.
CO3: Evaluate the port management system for integrating the various logistics operations.
CO4: Comprehend the various port facilities and structures for better shipment of goods & services.
CO5: Communicate the different processes and documentations by air and cargo transportation for optimized handling of goods and services.

Assessment Details

Continuous Internal Evaluation(CIE):

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B) The following are the Alternate Assessment Tools and not limited to: Quiz, Mini-Project, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Port Management and Operations.	Patrick M.Alderton	Information Law Category, U.K.	2008
2	Air Cargo Management	Yoon Seok Chang	CRC Press	2015
Reference Books				
1	Port Reform Tool Kit	WORLD BANK	World Bank, Washington	2007
2	Air cargo distributions: a management analysis of its economic and marketing benefits	Paul	Jackson and William Brackenridge	(Gower Press), 1988.
3	Port Management and Operations	MARIA G.BURNS	CRS Press, U.K.	2014

Semester: IV

Course Name: Global Supply Chain Management

Course Code	**21MBALS402**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Basics of logistics and supply chain
- Awareness of distribution channel and material handling.
- Knowledge of supply chain in global prospective

Module 1 – Distribution Management & Global Logistics 08 Hours

Need for physical distribution – functions of distribution –marketing forces affecting distribution. Global purchasing trends. Purchasing in global supply chain – critical success factors.

Global Logistics: Introduction – Global Logistics Meaning and Definition and Importance – Global market forces – FactorsInfluencing Global Market Forces – Factors Influencing Technological Forces– Global Cost Forces – Political and Economic Forces.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.

Skill Enrichment Exercises: Students should choose logistics firms and identify the critical success factors and external influencing factors for the same.

Module 2 – Distribution Channel & Risk Management in Global Scenario 08 Hours

Channels of distribution: role of marketing channels – channel functions – channel structure –designing distribution channel – choice of distribution channels – factors affecting. Intermediaries: functions of intermediaries – types of intermediaries – variables in selecting channel members – motivating – training – evaluating channel members – modifying channel arrangements.

Risk Management – Meaning and Definition, Introduction to Global Risks-Global Risks – Managing Global Risks.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.

Skill Enrichment Exercises: Student should overview and draft the comparative analysis of 2 company's channels of distribution.

Module 3 - Distribution control & Evaluation 08 Hours

Distribution control – stages of control process – standards & goals– performance report - measurement – monitoring – corrective action. Organization forDistribution: Distribution Organization structure – Private & Publicorganizations - conflict resolution – rising costs& need for control –complexities of physical distribution.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.

Skill Enrichment Exercises: Students should evaluate the different conflicts in the distribution channel and suggest appropriate resolutions.

Module 4 –International SCM & Material Handling in Logistics 08 Hours

International Supply Chain Management: Introduction to International Supply chain – Issues in International Supply Chain Management, International versus Regional Product. Role of Material Handling in Logistics – Material Handling Guidelines – Material Handling Equipment and Systems – Automated Material Handling, Benefits of Logistics Outsourcing – Third Party Logistics – Fourth Party Logistics – Value Added Services.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:**Case study on outsourcing**.**

Module 5–Performance Evaluation & Global Strategy Implementation 08 Hours

Performance Expectation & Evaluation: Regional differences in Logistics – Cultural differences in different places – Geographicinformation Systems- Infrastructure – Performance Expectation and Evaluation. **Global Strategy Implementation:**Requirements for Global Strategy – Global Strategy implementation – Miscellaneous DangersInformation system Availability – Human Resources – role – significance.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:**Case study on global strategy implementation for distribution and SCM

Course Outcomes: At the end of the course the student will be able to:

CO1: Apply the strategic role of Logistics and Supply chain Management in global operations.
CO2: Analyze the different distribution networks of the firms with global perspective.
CO3: Evaluate the varied distribution process to predict the control operations in SCM.
CO4: Comprehend the global SCM and suggest material handling systems for appropriate industries.
CO5: Communicate the cultural and global strategy of SCM in implementation and performance review.

Assessment Details

Continuous Internal Evaluation(CIE):

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini-Project, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.

- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Basics of Distribution Management: A Logistical Approach	KapoorSatish K., and KansalPurva	Prentice Hall of India	Latest Edition
2	Global Logistics & Supply Chain Management	John Mangan, Chandra Lalwani	Tim Butcher John Wiley & Sons	2nd Edition, 2011
Reference Books				
1	Designing & Managing the Supply Chain	David Simchi, Levi, Philip Kaminsky, Ravi Shankar	Tata McGraw Hill	14th Edition, 2010.
2	Distribution and Logistics Management: A Strategic Marketing Approach	D K Agrawal	Macmillan publishers India	Latest Edition
3	International Logistics: The Management of International Trade Operations	Pierre David	Paperback – Import	1 Dec 2013

Semester: IV

Course Name: Export Import Management

Course Code:	**21MBALS403**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Basic knowledge on International Trade
- Fundamental knowledge Cargo and Shipment process.
- Basic awareness of the national and international trade law

Module – 1 Export-Import Trade: Introduction to Regulatory Framework 8 Hours

Introduction, trade policy, foreign trade, simplification in documentation (developments in august, 2005), DGFT related documentation at a single place, reduction of documents to five for customs purposes. ESTABLISHING A BUSINESS FIRM: Selection of Name of Firm, Approval to Name of Firm, Registration of Organization, Opening of Bank Account, Obtaining Permanent Account Number, Registration with Sales Tax Authorities, Importer-Exporter Code number, Registration cum Membership Certificate, Registration with ECGC, Registration under Central Excise Law, Registration with other Authorities, Registration for Business Identification Number, Export Licensing
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:**Students are assigned to select a firm and reports of its registration.

Module – 2 Documentation Framework-Aligned Documentation System(ADS)
8 Hours

Objective, advantages of aligned documentation system, situation today, Commercial documents: principal export documents, Auxiliary export documents, Regulatory documents. Classification of commercial and regulatory documents: documents related to goods, Documents related to shipment documents related to payment,
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:**Students are assigned to collect and present as assignment of Documents related to shipment documents related to payment for a selected firm.

Module – 3International Business Contracts 8 Hours

Introduction: Distinction between domestic sales contract and export sales contract conflict of laws, Constructed contract, Incoterms 2000, Types of contracts: Major laws having bearing on export contracts elements in export contracts.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.

Skill Enrichment Exercises: Students are made to present different Incoterms of any choice of one company.

Module – 4Legal dimensions and Terms of Payment **8 Hours**

Legal dimensions: Relating to export-import contracts, relating to relationships between exporter andAgents/distributors: relating to products relating to letters of credit.
Introduction to Terms of Payment: What factors determine terms of payment, Methods of receiving payment, Payment in advance documentary bills, Documentary credit under letters of credit,

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercises: Students are made to present different Terms of Payment for any particular company

Module – 5Instruments of Payment & Methods of Financing Exports **8 Hours**

Introduction: Instruments of payment, Pre-shipment finance: Packing credit, advances against incentives receivable from government, pre-shipment credit in foreign currency. Post shipment: finance, negotiation of export documents under letters of credit, Purchase/discount of foreign bills, advance against export bills sent on collection.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercises: Students are assigned to draft and present Instruments of payment by selecting any one firm.

Course Outcomes: At the end of the course the student will be able to:

CO1: Apply the concepts domestic and foreign trade process for appropriate firms.
CO2: Analyze the different documentation for Export and imports trade process.
CO3: Evaluate the different kind of contractual agreement for the appropriate trade.
CO4: Design appropriate legal aspects and Terms of Payment in Exim trade.
CO5: Communicate the appropriate instruments and financing for export process.

Assessment Details

Continuous Internal Evaluation(CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini-Project, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Export and Import Procedures Documentation and Logistics	C Ram Gopal	New age International Ltd Publishers	2008 latest edition ISBN (10) : 81-224-2326-4 ISBN (13) : 978-81-224-2326-6
2	Export Import: Procedure and Documentation	Sultan Ahmad	Sultan Chand & Sons	Ist Edition2021 ISBN13: 978-81-951043-6-9
Reference Books				
1	Export/Import Procedures and Documentation	Thomas E. Johnson	Amacom	Amacom; 4th edition April2010 ISBN-10 : 0814415504 ISBN-13 : 978 0814415504
2	Export Procedures and Documentation	SudhirKochhar	Gullybaba Publishing House	2015 ISBN: 9789381970812, 9381970815

Semester: IV

Course Name: International Logistics Management

Course Code:	**21MBALS404**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:
- Basic knowledge on Logistic
- Fundamental knowledge Global Markets,
- Awareness of the basic economic trade process

Module – 1 Foundation Concepts in International Logistics **8 Hours**
Overview of International Logistics- Components, Importance, Objectives;Barrier to Internal Integration. Managing the Supply Pipeline for Global Trade Flows, The Global Logistics Operators,Comparison between National (Domestic) and International Logistics, International Transport, Globalization and International Trade Environment. Factors Driving Global Supply Chain Management, Customs and Global Supply Chain Management.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:**Students are requested present the concepts of environment. factors driving international logistics.

Module – 2 Export Sales Contract in International Logistics8 Hours
Constituents of the Export Sales Contract, Contract of Affreightment: Terms of Delivery &Incoterms standards. International Purchasing Systems, Constituents/Strategy and its Interface with the Management of the Global Supply Chain, Negotiating the Contract, Selecting the International Logistics Operator, Criteria of Selecting the Third-Party Logistics Operator.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:**Students are assigned to submitted the different Export Sales Contract

Module – 3 Integrating International Logistics with Supply Chain **8 Hours**
Trade-Offs in International Logistics, Multi-Modalism, Key Factors in a Transport Mode(s) & Trade-Off. Considerations of Speed, Frequency, Packing and Insurance in International Transportation. Warehousing & Benchmarking in Global Supply Chain Management, Supply Chain Cycle Time Reduction, Demand-Driven Supply Network in International Logistics.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:**Students are assigned to draft different internal warehousing management activities in different industry

Module – 4 International Transport Systems 8 Hours

Introduction to International Transport System- Basic Terms, Characteristics and Relations,Significance of Transportation Services, Characteristics of Modes of Transports –Road Transportation, Rail Transportation, Maritime Transport, Air Transport. Intermodal Transportation, Technical performance & Transport Economic Indicators, Maritime Routing Patterns, The Containerization of Commodities, Transcontinental Bridges.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:**Students are assigned to submitted the draft of different International Transport modes used by company

Module – 5 Cost and Economy of International Logistics 8 Hours

International Transport and Economic Development, Transportation and Commercial GeographyInternational Transport Costs, International Transport Supply and Demand, Location Analysis,Market Area Analysis, The Nature of International Transport Policy, International TransportPlanning, International Transport Safety and Security, Traffic Counts and Traffic Surveys, Cost /Benefit Analysis.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:**Students are assigned to present factors effecting the **Cost** and Economy of International Logistics of a two companies

Course Outcomes: At the end of the course the student will be able to:

CO1: Apply the concepts of principles of international logistics Operation in appropriate sectors. **CO2:** Analyze in different Export Sales Contract in Logistics operations **CO3:** Evaluate the parameters for integrating the international Logistics and supply chain management **CO4:** Design suitable modes of International logistic Transport system in the appropriate industry **CO5:** Communicate the appropriate components of cost factors and Economic Development steps for the International Logistics

Assessment Details

Continuous Internal Evaluation(CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini-Project, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	International Logistics	Pierre David	Wiley;	1st edition ISBN-10 : 8177224301 ISBN-13 : 978-8177224306
2	International Logistics Management	Robert Chira	Author house	**25 July 2016** ISBN-10 : 1524632082 ISBN-13 : 978-1524632083
Reference Books				
1	"The Geography ofTransport Systems"	Jean-Paul Rodrigue, Claude Comtois and Brian Slack	Routledge,	(2009), New York:
2	"Intermodal Freight Requirements,"	LaLonde, Bernard J.	Macmillan	8th Edition,
3	International Logistics: The Management of International Trade Operations	Pierre David	Cicero	1 Dec 2013 4th edition ISBN-10 : 0989490602 ISBN-13 : 978-0989490603

Semester: IV

Course Name: Containerization and Multimodal Transport

Course Code:	**21MBALS405**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**

Pre-requisites:

- Basic knowledge on Supply Chain
- Fundamental knowledge marketing, production.
- Awareness of the manufacturing and trading process

Module – 1 Basic Concepts of Containerization 8 Hours

Meaning - Major Container Trades - Container Operators - Container Ships - Terminal-Consideration of Container Terminal Planning - Container Distribution – Container types - ISO Container Dimension by types - Non- Containerisable cargo - Features of Containerization - Equipment for non-containerisable cargo.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:**Students are assigned to draft assignment on different containers and the shipping process of containers

Module – 2 Cargo 8 Hours

International Trade Distribution - Stowage: Meaning - Stowage of cargo – Factor Consideration - Types of cargo - Characteristics - Cargo and Container handling equipment - Types of Packing- Marking of cargo - Dangerous Cargo - IMDG Code – Classes.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:**Students are assigned different logistics company and asked to analyze with the shipping parameters.

Module – 3 Multi Modalism 8 Hours

Multi-modal Trade Routes - Evolution – Basic Intermodal System - Modal Interface Factors outline why shipper favour Multi-modalism - Factors in Development Features - Multi-Modalism Strategy – Components
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:**Students are made to present different Multi-modal Trade Routes on air, water, road and rail.

Module – 4 Physical Multi Modal Operations 8 Hours

Liners - Tramps - Specialized Vessels - Terms - Road transport vehicle – Road Transport Weight and Measurement - Rail Transport Vehicle and Equipment – Air Transport - Ports - LCL - FCL - NVOCC - Freight forwarders - Consolidator – ICD CFS- Free Trade Area - SEZ - Factors affecting mode and route choice.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential

Learning. **Skill Enrichment Exercises:**Students are made to present different mode of transportations of goods and highlight the advantages and the disadvantages of each Physical Multi Modal Operationsof transportation

Module – 5 Contract	**8 Hours**
International contract of sale-Bill of Lading-Clauses-Way bills-Identity of Carrier-Liability and Insurance-Paperless Trading, Indian Multimodal Act- 1993,Conventions related Multi modal transport-Cargo liability conventions, Conventions relating Dangerous Goods-Cusms conventions-Statutory Regulations and Restrictions-National and International restrictions on the movement of goods.	
Teaching-Learning Process:	
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:** Students are assigned to draft and present different types of contract in Logistics and supply chain management.	

Course Outcomes: At the end of the course the student will be able to:

CO1: Apply the concepts of the containerization in logistics process.
CO2: Analyze the different International Trade Distribution in Logistics management.
CO3: Evaluate the various Multi-modal Trade Routes in the logistic system.
CO4: Design appropriate design for the multi-modal operations.
CO5: Communicate the appropriate contractual agreement in the Shipping Process

Assessment Details

Continuous Internal Evaluation(CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini-Project, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Containerization,	K. V. Hariharan,	Shroff Publishers &	1st edition

	Multimodal Transport & Infrastructure Development In India,		Distributers Private Limited - Mumbai	8173665516
2	Supply Chain Management- Strategy, Planning and Operation	Sunil Chopra, Peter Meindl, D.V.Kalra	Pearson	Latest edition
Reference Books				
1	Transportation Engineering: An Introduction,	JotinKhisty C and Kent Lall B,	Prentice Hall International	3rd edition 2002.
2	Principles of Urban Transport Systems Planning,	Hutchinson B.G,	McGraw-Hill Book Company	(Latest edition), 2013.
3	Branch’s Elements of Shipping.	Alan E Branch & Michael Robarts (2014)	Routledge Publication.	9th Edition,
4	Logistics and Multi-modal Transport.	Claus, Hyldager (2013)	Institute of Charted Shipbrokers.	2013 Edition,

Semester: IV

Course Name: Supply Chain Information System

Course Code:	**21MBALS406**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Basics of Supply Chain.
- Fundamental knowledge of Communication Networks.
- Basics of Logistics.

Module – 1 Electronic SCM, Communication Networks **8 Hours**
Introduction eSCM- eSCM Framework - Key Success Factors for eSCM - Benefits of eSCM- Positioning Information in Logistics - Strategic Information Linkage - Supply Chain Communication Networks - Role of Communication Networks in Supply Chains - Overview of Telecommunication Networks –EDI - Data Security in Supply Chain Networks
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:** Draft & Present the Communication Networks used in Supply Chain Management

Module – 2 Enterprise Information Systems **8 Hours**
Overview of Enterprise Information Systems - Information Functionality and Principles - Introduction Enterprise Information Systems -Classification of Enterprise Information Systems - Information Architecture -Framework for Managing Supply Chain Information - Describe ion on Popular Enterprise Application Packages -Benefits of Enterprise Information Systems
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:**List out the best enterprise software & tools for sustainable business growth

Module – 3 SCM Systems Development **8 Hours**
Stakeholders in Supply Chain Information Systems - Stakeholders in SCM - Stakeholders in Supply Chain Information Systems - Information Systems Development- Logistics Information Systems Design- Defining Enterprise Architecture - Choosing Appropriate System Development Methodologies - Adopting Relevant Systems Development Model
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises: Draft & Present the 5 top companies that use enterprise architecture**

Module – 4 Deployment and Management **8 Hours**
Information Systems Deployment - IT Operations and Infrastructure Management - Portfolio, Program and Project Management - Management of Risk - Management of Value
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:** Draft & Present the best practices for managing a Project

Module – 5 Information Integration **8 Hours**
Enterprise Application Integration and Supply Chain Visibility **-** Enterprise Application Integration - Supply Chain Visibility - Supply Chain Event Management -Supply Chain Performance **-**Planning and Design Methodology **-** Problem Definition and Planning - Data Collection and Analysis - Recommendations and Implementation -Decision Support Systems
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video Clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises: Plan and Design a methodology for Supply Chain Performance**

Course Outcomes: At the end of the course the student will be able to:

CO1: Apply the concepts of Supply Chain Management Communication Networks to solve the business problems. CO2: Analyze Enterprise Information Systems. CO3: Evaluate various information systems development methodologies. CO4: Design various information system deployment methods. CO5: Create new set of information for business decision making.

Assessment Details

Continuous Internal Evaluation(CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini-Project, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Business Logistics Management	R.H. Ballou, and Samir	Pearson Education	5th Edition 2014
Reference Books				
1	E-Marketing	Strauss, Alexa & Frost	Routledge Tylor &rancis Group	8th New edition 2018
2	Statistics for Managers Using MS Excel	Levine & David	Pearson Education	8th Edition, 2017
3	Sustainable Logistics and Supply Chain Management: Principles and Practices for Sustainable Operations and Management	David B. Grant & Chee Yew Wong	Kogan Page	Edition 2, 2017

Semester: IV

Course Name: Risk Management & Insurance

Course Code	**21MBAFM401**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Knowledge of risk management
- Good communication and presentation skill
- Knowledge of insurance Industry

Module – 1 Introduction to Risk Management and Risk Identification 8 Hours

Risk – Risk and Uncertainty – Types of Risk – Burden of Risk – Sources of Risk- Methods of handling Risk – Degree of Risk- Management of Risk. Risk Identification- Business Risk Exposures – Individual Exposures – Exposures of Physical Assets – Exposure of Financial Assets – Exposures of Human Assets – Exposures to Legal Liability- Exposure to Work-Related Injury.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study **Skill Enrichment Exercise: Study the types of risks in different industries.**

Module – 2 Risk Management Techniques 8 Hours

Risk Management – Evaluating the Frequency and Severity of Losses – Risk Control – Risk Financing Techniques – Risk Management Decision Methods – The changing scope of Risk Management –Insurance Market Dynamics – Loss Forecasting – Financial Analysis in Risk Management-Decision Making – Other Risk Management Tools.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study **Skill Enrichment Exercise: Study the modern risk management tools and techniques**

Module – 3 Basics of Insurance 8 Hours

Introduction to Insurance Risk and Insurance – Definition and Basic Characteristics of Insurance – Requirements of an Insurable Risk – Adverse Selection and Insurance – Insurance Vs Gambling, Insurance Vs Hedging – Types of Insurance – Essentials of Insurance Contracts. Indian Insurance Industry – Historical Framework of Insurance, Insurance sector Reforms in India. IRDA – Duties and powers of IRDA – IRDA Act 1999.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study **Skill Enrichment Exercise: Study the structure of insurance organizations**

Module – 4 Life Insurance 8 Hours

Life Insurance – Basics of Life Insurance – Growth of Actuarial Science – Features of Life Insurance – Life Insurance Contract – Life Insurance Documents –Life Insurance

Classification – Classification on the Basis – Duration – Premium Payment – Participation in Profit – Number of Persons Assured – Payment of Policy Amount – Money Back Policies – Unit Linked Planned Plans – Annuity Vs Life Insurance – Classification of Annuities.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study **Skill Enrichment Exercise: Study the various types of life insurance policies.**

Module-5 General Insurance **8 Hours**

General Insurance Contract – General Insurance Corporation (GIC) – Health Insurance – Individual Medical Expense Insurance – Long Term Care Coverage –Disability Income Insurance – Medi-claim Policy – Group Medi-claim Policy – Personal Accident Policy – Employee Group Insurance – Features of Group Health Insurance – Fire Insurance – Essentials of Fire Insurance Contracts – Types of Fire Insurance Policies – Marine Insurance – Types of Marine Insurance – Marine Insurance principles- Motor Vehicles Insurance – Need for Motor Insurance – Types of Motor Insurance – Factors to be considered for Premium Fixing
Teaching-Learning Process:
Pedagogy: Lecture, Case Study **Skill Enrichment Exercise: Study the various types of general insurance policies.**

Course Outcomes: At the end of the course the student will be able to:

CO1: Analyze the various types of risks and their exposures.
CO2: Apply the tools and techniques of risk management.
CO3: Apply the rules and regulations of IRDA to insurance business.
CO4: Evaluate the different life insurance policies.
CO5: Evaluate the types of general insurance policies.

Assessment Details

Continuous Internal Evaluation(CIE) :

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1.	Principles of Risk Management and Insurance	George E Rejda	Pearson	12th Edition, 2009
2.	Insurance and Risk Management	P.K.Gupta	Himalaya Publishing House	1st Edition, 2010
3.	Introduction to Risk Management and Insurance	Dorfman, Mark S	Prentice Hall India	10th Edition, 2008
Reference Books				
1.	Risk Management and Insurance	Scott. E. Harrington Gregory R Niehaus	Tata McGraw Hill Publishing Company Limited	2nd Edition 2007
2.	Principles and Practice of Insurance	P. Periasamy	Himalaya Publishing House	2nd Edition 2009
3.	Risk Management and Insurance	C. Arthur Williams Jr. Peter Young Michael Smith	Tata McGraw Hill Publishing Company Limited	8th Edition 2007

Semester: IV

Course Name: Wealth Management

Course Code	**21MBAFM402**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Knowledge of Financial Planning.
- Good communication and presentation skill
- Knowledge of investment

Module – 1 Introduction: Financial Planning **8 Hours**

Background- Role of Financial Planner- Financial Planning Process - Contract and Documentation- Client Data Collection- Client Data Analysis - Life Cycle - Wealth Cycle- Risk Profiling and Asset Allocation- Systematic Approach to Investing: Systematic Investment Plan (SIP), Systematic Withdrawal Plan (SWP), Systematic Transfer Plan (STP)- Financial Plan-Goal-based Financial Plan, Comprehensive Financial Plan- Financial Blood-Test Report (FBR) - Financial Planning in India
Teaching-Learning Process:
Pedagogy: Lecture, Case Study **Skill Enrichment Exercise: Study the financial planning process**

Module – 2 Wealth Management & the Economy **8 Hours**

Wealth management philosophy, process, Financial Planning to Wealth Management, Financial Planning Vs Wealth Management, Economic Cycles and Indicators- Lag Indicators, Co-incident Indicators, Lead Indicators- Interest Rate Views- Currency Exchange Rate- The Deficits: Revenue Deficit and Fiscal Deficit, Current Account Deficit
Teaching-Learning Process:
Pedagogy: Lecture, Case Study **Skill Enrichment Exercise: Study the Economic Cycles and Indicators**

Module-3 Investment & Risk Management: Equity & Debt **8 Hours**

Role of Equity- Active and Passive Exposures – Returns from Passive Exposure to S&P CNX Nifty - Sector Exposure and Diversification- Fundamental and Technical Analysis- Fundamental Valuation Approaches- Investment and Speculation-Leveraging Role of Debt - Deposits and Debt Securities- Valuation of Debt Securities-Yields and Interest Rate Risk-Interest Rate and Debt Investments-Credit Exposure and Debt Investments-Concentration Risk-Passive Investments in Debt
Teaching-Learning Process:
Pedagogy: Lecture, Case Study **Skill Enrichment Exercise: Study the role of Equity and Debt**

Module-4 Investment & Risk Management: Alternate Assets **8 Hours**

Gold: Role of Gold - Gold Investment Routes- Rupee returns from Gold Real Estate- Role of Real Estate- Real Estate Investment Routes - Real Estate Indices Financial derivatives – meaning- need- benefits and types of derivatives

Teaching-Learning Process:
Pedagogy: Lecture, Case Study **Skill Enrichment Exercise: Study the relevance of Gold and Real Estate as a strategic asset**

Module-5 Risk Profiling & Asset Allocation	**8 Hours**
Risk Profiling - Why Asset Allocation - Strategic Asset Allocation- Tactical Asset Allocation- Fixed Asset Allocation - Flexible Asset Allocation - Asset Allocation Returns in Equity and Debt: Fixed Asset Allocation with Annual Re-balancing, Flexible Asset Allocation - Asset Allocation Returns in Equity, Debt and Gold: Fixed Asset Allocation with Annual Re-balancing, Flexible Asset Allocation- Allocation to Speculation- Diversification in Perspective	
Teaching-Learning Process:	
Pedagogy: Lecture, Case Study **Skill Enrichment Exercise: Study the risk profiling aspects of investors**	

Course Outcomes:
At the end of the course the student will be able to:

CO1: Apply the concepts of financial planning. CO2: Analyze the process, phases and growth of Indian wealth management market CO3: Analyze the ability to invest and understand the time of investment in equity & debt. CO4: Evaluate the types of alternate asset classes. CO5:Communicate the role of Asset Allocation and wealth management strategies

Assessment Details

Continuous Internal Evaluation(CIE) :

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**

Textbooks				
1.	Wealth Management	Dun & Bradstreet	Tata McGraw Hills Publications	2009
2.	Wealth Management & Financial Planning Concepts & Practices	Balaji Rao D.G.	Partridge Publishing India	2015
3.	Wealth Engine: Indian Financial Planning & Wealth Management Handbook	SundarSankaran	Vision Books	2012
Reference Books				
1.	Wealth Management in the New Economy: Investor Strategies for Growing, Protecting and Transferring Wealth.	Norbert M. Mindel&Sarah E. Sleight &	Wiley	1st edition, February, 2010

Semester: IV

Course Name: Indirect Taxation

Course Code	**21MBAFM403**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Basic Knowledge of Annual Budget.
- Fundamentals of Macro Economics.
- Awareness of Taxation policies

Module – 1 Introduction to GST **5 Hours**

Goods and Services Tax Act: Definitions, Need for GST in India, Dual GST Model.
Scope of Supply; Types/ Classification of Supplies Composite and Mixed Supplies
Levy Of GST: Chargeability of GST on Supplies ,aggregate turnover

Teaching-Learning Process:

Pedagogy: Lectures, Case Study etc.,
Skill Enrichment Exercise: Apply the GST principles by a survey among local business community about compliance with GST regime.

Module – 2 Time and Value of Supply **12 Hours**

Time of Supply, Change in Rate of Tax in respect of Supply of Goods or Services, Place of Supply and Value of Supply.
Simple problems on Time of supply and value of supply

Teaching-Learning Process:

Pedagogy: Lectures, Case Study etc.,
Skill Enrichment Exercise: Assess the GSTR 1 & GSTR 3B, E way Bill and How to calculate and avail Input Tax Credit(ITC) using time and place of Supply

Module – 3 Registrations & Assessment in GST **7 Hours**

Registration under GST: Persons not liable for Registration, Compulsory Registration in Certain Cases, Procedure for Registration, Deemed Registration.
Returns under GST: Furnishing of Returns, First Return, Revision of Returns and Penalty/Late Fee.

Teaching-Learning Process:

Pedagogy: Lectures, Case Study etc.,
Skill Enrichment Exercise: Analyze documents pertaining to Registration under GST and Returns under GST

Module – 4 Customs Duty **10 Hours**

Introduction to Custom duty, Definitions of Assessable value, types of duties, rates of custom duty and other duties including cess, Valuation of Imported Goods.

Assessment of Customs; determination of value of goods and tax liability of imported goods.

Simple numerical problems on customs. (Theory and Problems).
Teaching-Learning Process:
Pedagogy: Lectures, Case Study etc., **Skill Enrichment Exercise:** Explore various forms and rules used in Custom duty

Module – 5 Baggage & Introduction to FTP 6 Hours

General Free Allowance. Penalties under Customs, Seizure of Goods, Confiscation of Goods. Baggage principles, limit on clothing, laptops, electronics, liquor and alcohol. Limit applicable to people travel from Bhutan, Myanmar, China and Nepal. Limit applicable to people travel from other countries other than who travel from Bhutan, Myanmar, China and Nepal. Determination of baggage value; simple problems. (Theory & Problems).
Teaching-Learning Process:
Pedagogy: Lectures, Case Study etc., **Skill Enrichment Exercise:** Apply relevant case studies and the provisions of FTP in the recent times.

Course Outcomes: At the end of the course the student will be able to: CO1: Apply theoretical knowledge of GST for determination of GST levy. CO2: Analyze the Time, Place & Value of supply CO3: Evaluation of assessment and returns in GST CO4: Determine the custom duty liability CO5: Prepare the statement showing the value of baggage

Assessment Details

CIE:

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50. The question paper will have 8 full questions carrying equal marks.

- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions, selecting four full question from question number one to seven and question number eight is compulsory.
- 40 percent theory and 60 percent problems in the SEE

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Indirect Taxes Law and practices	V S Datey	Taxman's	Latest Edition
2	GST & Customs Law (University Edition)	K.M Bansal	Taxman's	Latest Edition
3	Goods and Services Tax	Dr B Mariyappa	HPH	Latest
Reference Books				
1	Principles of GST & Customs Law	V.S. Datey and Dr. Krishnan Sachdeva	Taxman's	Latest Edition
2	Goods & Services Tax (GST) in India	B. Viswanathan	UBS Publishers	Latest Edition
3	Indirect Taxation	Raj K Agrawal & Shivangi Agrawal	Bharat Law House Pvt. Ltd	Latest Edition

Semester: IV

Course Name: Financial Derivatives

Course Code	**21MBAFM404**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Basic knowledge of finance
- Understanding of international business environment
- Through knowledge in capital markets

Module – 1 Foundation of Financial Derivatives 08 Hours

Meaning, benefits, types (both exchange traded and OTC traded) and features of financial derivatives-Factors causing growth of derivatives-functions of derivatives market-Derivative market players (Hedgers, speculators and arbitragers)-Derivatives market in India. Commodity Derivative Market: Meaning of commodity derivatives-Commodity derivative exchanges (with commodities traded) in India-Trading and settlement system of commodity derivatives-SEBI Guidelines for commodity market-commodities traded.

Teaching-Learning Process:

Pedagogy: Case Study
Skill Enrichment Exercise: Visit the website of FEDAI and understand the regulations for Commodity Exchanges

Module – 2 Futures and Forwards 08 Hours

Meaning, features and types of futures/forwards-Futures vs Forwards-Mechanics of buying and selling futures/forwards-Hedging through futures/forwards-Marking-to-market process-contract specifications of stock, index and commodity futures–valuation of futures/forwards using cost of carry model-Arbitrage process-Interest Rate Futures & options. (Numerical problems on MTM and valuation of futures/forwards).

Teaching-Learning Process:

Pedagogy: Case Study
Skill Enrichment Exercise: Study the different types of Future contracts traded on NSE

Module – 3 Option Contracts 08 Hours

Meaning, features and types of option contracts-Options vs futures/forwards-Mechanics of buying and selling option contracts-contract specifications of stock, index and commodity options-Option pricing-factors affecting option pricing-Valuation of option contracts using Black Scholes model and Binomial model-Put-call parity theory-Option Greeks-Option Trading strategies

Teaching-Learning Process:
Pedagogy: Case Study **Skill Enrichment Exercise:** Study the different types of Options contracts traded on NSE

Module – 4 Financial Swaps **08 Hours**

Meaning, features and advantages of financial swaps-Types of financial swaps (Interest rate swap, currency swap, equity swap and commodity swap)-Mechanics of interest rate swaps– Triangular swap (Numerical problems only on interest rate swap including triangular swap)-valuation of interest rate swaps- Only theory.
Teaching-Learning Process:
Pedagogy: Excel based calculation, research articles **Skill Enrichment Exercise:** Understand how different types of quotations helpful to the participants in Forex

Module – 5 Emerging trends in risk Management **08 Hours**

Exotic Options, Interest rate derivatives, Weather derivatives ,Energy derivatives, Insurance derivatives .Credit Derivatives-Total Return Swap (TRS)-Credit Default Swap (CDS)-Types of CDS-Asset Backed Securities (ABS)-Collateralized Debt Obligation (CDO)-Sub-Prime Crisis-2007-Credit Spread Options. Value-at-Risk-Meaning, VaR Models-Historical simulation-Stress testing and back testing –Model building approach ,Linear Model Monte Carlo simulation – (Numerical problems on model building approach only)
Teaching-Learning Process:
Pedagogy: Case study discussion, articles from Magazine and research related. **Skill Enrichment Exercise:** Case study on failure of credit derivatives and its implication of Sub Prime Financial Crisis-2007

Course Outcomes: At the end of the course the student will be able to:

CO1: Apply the principles and concepts of financial derivatives in derivative markets.
CO2: Apply the mechanism of forwards, futures, options and financial swaps.
CO3: Evaluate the financial derivatives using valuation models
CO4: Assess the commodity derivatives market in India
CO5: Evaluate various credit derivatives and VaR

Assessment Details

Continuous Internal Evaluation (CIE):

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative

and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 70 % Numerical and 30 % percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Options, Futures & Other Derivatives	John C. Hull	Pearson Education	8/e and 2013
2	Options & Futures	Vohra & Bagri	TMH	2/e
3	Financial Derivatives-Text & Cases	Prakash B Yaragol	Vikas Publishing	1/e and 2019
Reference Books				
1	Derivatives-Principles and Practice	Sundaram & Das	McGraw Hill	4th Edition
2	Derivatives and Risk Management	Rajiv Srivastava	Oxford University	2010
3	Financial Derivatives Modeling	Christian Ekstrand	Springer	

Semester: IV

Course Name: Behavioral Finance

Course Code	**21MBAFM405**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Fundamental of economics and finance
- Basics of saving and Investment
- Understanding of Capital market activities

Module – 1 Foundation of Rational Finance **08 Hours**

Expected utility theory, Modern portfolio theory, Capital asset pricing model (CAPM); efficient markets hypothesis; Agency theory; the influence of psychology. Efficient Markets versus Irrational Markets.
Teaching-Learning Process:
Pedagogy: Case Study **Skill Enrichment Exercise:** Discuss application of Event study methodology

Module – 2 Foundations of Behavioral Finance **08 Hours**

Introduction to Behavioral finance – Nature, scope, objectives and application; Investment Decision Cycle: Judgment under Uncertainty, debates of Standard Finance Versus Behavioral Finance, the three themes of Behavioral Finance.
Teaching-Learning Process:
Pedagogy: Case Study **Skill Enrichment Exercise:** Discuss articles contributed by Prof Daniel Kehmann Behavioral Theory

Module – 3 Behavioral Finance from Micro Level **08 Hours**

Define individual investor's biases, The Irrational Influence: heuristics Driven Biases(Representativeness, Overconfidence, Anchoring, Confirmation, Illusion of Control ,Affect heuristic , Regret aversion ,Aversion to ambiguity and Innumeracy),Frame Dependence(Prospect Theory, Mental Accounting ,Narrow Framing, Behavioral Portfolio). Strategies for Overcoming Psychological Biases.
Teaching-Learning Process:
Pedagogy: Case Study **Skill Enrichment Exercise:** Application of Behavioral bias to real life cases.

Module – 4 Behavioral Finance from Macro Level **08 Hours**

Define anomalies, types of Market anomalies: Fundamental Anomalies, Technical Anomalies, and Calendar Anomalies.
Teaching-Learning Process:
Pedagogy: Excel based calculation, research articles **Skill Enrichment Exercise:** Discuss Calendar anomaly using Econometrics

Module – 5 Advance Behavioral Finance	**08 Hours**
Market Bubbles: Identification and causes, investor behavior during bubbles, case study of prominent market bubbles/scams. Introduction to Behavioral Corporate Finance, Introduction to Neuro Finance.	
Teaching-Learning Process:	
Pedagogy: Case study discussion, articles from Magazine and research related. **Skill Enrichment Exercise:** Case study of Financial Crisis-2007 & Global Pandemic-COVID-19 on Stock Markets..	

Course Outcomes: At the end of the course the student will be able to:

CO1: Gain the knowledge of behavioral finance and its importance in investment decisions
CO2: Analyze the investor behavior during the market bubbles
CO3: Comprehend the apply the behavioral models for investment decision making.
CO4: Evaluate the investor behavioral bias and its implication
CO5: Identify the various development of in market behavior..

Assessment Details

Continuous Internal Evaluation (CIE) :

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
		Textbooks		
1	Behavioral Finance and Wealth Management	Michael M.Pompian	Wiley Publisher	2/e and 2012
2	Investment Analysis and Portfolio Management	Prasanna Chandra	McGraw Hill	4/e and 2014
	Beyond Greed and Fear	Hersh Shefrin	Publisher Oxford University Press	2007
		Reference Books		
1	The Psychology of	John R. Nofsinger	Pearson Prentice	4th Edition

	Investing		Hall	
2	The psychology of judgment and decision-making	Plous, S	McGrawHill.	
3	Inefficient Markets: An Introduction to Behavioral Finance	Shleifer, Andrei	Oxford University Press, Oxford.	2000
4	The Scam	Debashis Basu , Sucheta Dalal	Kensource	4th Edition

Semester: IV

Course Name: International Financial Management

Course Code	**21MBAFM406**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Key personal skills including presentation, argumentation, evaluation, problem solving, self-appraisal, and autonomy
- Theoretical knowledge to personal investments and financial careers
- Knowledge of Business, Accounting, International Studies, Economics

Module – 1 International Financial Environment **8 Hours**

Importance, rewards & Risk of international finance- Goals of MNC- International Business methods. Balance of Payments (BoP), Fundamentals of BoP, Accounting components of BOP, Equilibrium & Disequilibrium, International Monetary System: Evolution, Gold Standard, Bretton Woods system, the flexible exchange rate regime, the current exchange rate arrangements, the Economic and Monetary Union (EMU). (Only Theory).
Teaching-Learning Process:
Pedagogy: Lecture, Case Study **Skill Enrichment Exercise:** Study the BOP of India for the last 5 years

Module – 2 Foreign Exchange Market **8 Hours**

Function and Structure of the Forex markets, Foreign exchange market participants, Types of transactions and Settlements Dates, Exchange rate quotations, Determination of Exchange rates in Spot markets. Exchange rates determinations in Forward markets. Exchange rate behaviour-Cross Rates- - Bid – Ask – Spread (Theory & Problems).
Teaching-Learning Process:
Pedagogy: Lecture, Case Study **Skill Enrichment Exercise:** Track and analyze the rupee exchange value against Dollar and Euro in spot and forward markets for one week and record the observations

Module – 3 International Financial Markets and Instruments **8 Hours**

Foreign Portfolio Investment. International Bond & Equity market. GDR, ADR, International Financial Instruments: Foreign Bonds & Eurobonds, Global Bonds. Floating rate Notes, Zero coupon Bonds, International Money Markets, International Banking services –Correspondent Bank, Representative offices, Foreign Branches. Forward Rate Agreements. (Only Theory).
Teaching-Learning Process:
Pedagogy : Lecture, Case Study **Skill Enrichment Exercise:** Visit the foreign exchange department of a bank, study the operations and submit a report

Module – 4 Forecasting Foreign Exchange rate 8 Hours
International Parity Relationships, measuring exchange rate Movements-Exchange rate equilibrium –Factors effecting foreign exchange rate- Forecasting foreign exchange rates. Interest Rate Parity, Purchasing Power Parity &International Fisher effects, Arbitrage, Types of Arbitrage – Locational, Triangular and Covered Interest Arbitrage. (Theory & Problems).
Teaching-Learning Process:
Pedagogy: Lecture, Case Study **Skill Enrichment Exercise:** Examine the relationship between inflation level and Purchasing power parity

Module – 5 Foreign Exchange exposure 8 Hours
Foreign Exchange exposure: Management of Transaction Exposure-Management of Translation Exposure Management of Economic Exposure-Management of political Exposure- Management of Interest rate exposure. (Theory & Problems).
Teaching-Learning Process:
Pedagogy: Lecture, Case Study **Skill Enrichment Exercise:** Study the different types of swaps used in Foreign Exchange Market

Course Outcomes: At the end of the course the student will be able to:

CO1: Apply the fundamentals of balance of payment in International Financial Environment
CO2: Analyze the foreign exchange market, participants and transactions.
CO3: Evaluate the International Financial Markets and Instruments
CO4: Forecast the Foreign Exchange rate
CO5: Evaluate the manage the foreign Exchange exposure

Assessment Details

Continuous Internal Evaluation(CIE) :

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 50 percent theory and 50 percent problems in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	International Corporate Finance	Jeff madura	Cengage Learning	10/e 2012
2	International Finance Management	Eun & Resnick	Tata McGraw Hill	4/e, 2014
3	Financing International Trade: Banking Theories and Applications	Gargi Sanati	Sage Publication	1/e, 2017
Reference Books				
1	International Financial Management	Apte P. G	Tata McGraw Hill	6/e, 2011
2	International Financial Management	MadhuVij	Excel Books	2010
3	International Financial Management	Thummuluri Siddaiah	Pearson India	1/e, 2009

Semester: IV

Course Name: Sales Management

Course Code	**21MBAMM401**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Fundamentals of Marketing Management.
- Basics of Distribution Chanel Network
- Basics of Trade and Commerce

Module – 1 Introduction to sales management 08 Hours

Meaning, Evaluation, Importance, Personal Selling, Emerging Trends in Sales Management, elementary study of sales organizations, qualities and responsibilities of sales manager. Types of sales organizations. Sales as a career, Changing role of sales force, Revolution in Technology, Customer Relationship Management (CRM), and Sales force Diversity, Team Selling Approach, and Managing Multi-channels.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.

Skill Enrichment Exercise:

Interview a salesperson and write a brief report about what they like and dislike about their jobs, their salary, travelling allowances, sales quotas, why chose sales career, and what does it take to succeed in this profession.

Module – 2 Selling Skills & Selling Strategies 06 Hours

Selling and buying Styles, selling skills, situations, selling process, sales presentation, Handling customer objections, Follow-u action.

Management of Sales Territory & Sales Quota: Sales territory, meaning, size, designing, sales quota, procedure for sales quota. Types of sales quota, Methods of setting quota

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.

Skill Enrichment Exercise:

Ask your friends if they would buy certain goods like groceries, vegetables, socks, mobile, pens etc from the roadside vendor as against a regular shop. Group the products into low risk and high risk ones.

Module – 3 Management of Sales Territory & Sales Quota 10 Hours

Sales territory, meaning, size, designing, sales quota, procedure for sales quota. Types of sales quota, Methods of setting quota. Standard sales management process-international sales management -international market selection market survey approach or strategy.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.

Skill Enrichment Exercise:

Students are asked to prepare presentation on any product or the services of student choice, covering selling strategies and sales process.

Module – 4 Sales Force Recruitment. and Selection 08 Hours

Recruitment and selection of sales force, Training of sales force. Sales force motivation and compensation Nature of motivation, Importance, Process and factors in the motivation, Compensation-Meaning, Types of compensation plans and evaluation of sales force by performance and appraisal process.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.

Skill Enrichment Exercise:

As a sales manager of a company. You make an analysis of what you feel should be roles of a sales manager and a salesperson for maximizing sales of the organization.

Module – 5 Sales Managers and Sales Person 08 Hours

Role of sales manager and sales people; functions of sales manager, functions of sales person, types and characteristics of sales manager and sales people-Time management for sales manager and sales person

Selling on the internet: Selling agents for internet trading-net selling, advertising in net trading, payment system in internet trading-smart card, credit card, debit card- payment by card: advantages and disadvantages; How to make internet selling safe-Digital signature, biometric method and legal or regulatory environment; Growth of internet trading in India.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.

Skill Enrichment Exercise:

Students are to indentify current issues in internet trading is: how to make internet selling safe. Different methods have been suggested for safety or security of internet trading. You have to analyze different methods and recommend a method for your company.

Course Outcomes: At the end of the course the student will be able to:

CO1: To apply the fundamental principles of sales management, used in appropriate selling situations in selling process

CO2: To analyze the various selling skills and techniques to develop effective sales administration through sales territories.

CO3: To evaluate the use of various plan of compensation and control techniques.

CO4: To communicate various motivation concepts for effective implementation of sales management plans.

CO5: To design and monitor the effective sales Process with use of human and IT trails.

Assessment Details

CIE:

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Sales Management	Charles, Futrell	Thomson South Western	6/e, 2003.
2	Sales & Distribution Management,	Tapan K. Panda & Sunil Sahadev,	Oxford University Press.	6/e
3	Managing of Sales Force	Spiro Stanton Rich	TMH	11/e, 2003.
Reference Books				
1	Sales & Retail Management, an Indian perspective	Dr.S.L Gupta,	Excel Books	1/e, 2007.
2	Salesmanship and Sales Management	P.K Sahu & K C Raut	Vikas Publishing House	3/e,
3	Sales Management- -	Douglas J Dalrymple, William L Crowe	John Wiley & Co	Latest edition

Semester: IV

Course Name: Integrated Marketing Communication& Advertising

Course Code	**21MBAMM402**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Basic fundamentals of Marketing.
- Knowledge about the fundamentals of promotions.
- Thoughtful knowledge about marketing strategies & plans.
- Creative thinking & Configuration of skills.

Module 1 – Role of IMC in Marketing Process 08 Hours

Role of IMC in marketing process, IMC planning model, Marketing and promotion process model. Communication process, steps involved in developing IMC programme, Effectiveness of marketing communications Purpose, Role, Functions, Types, Advertising V/s Marketing mix, Advertising appeal in various stages of PLC.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercises: Choose a product of your choice and design the marketing mix.

Module 2 - Advertising Agency and Communication Process 08 Hours

Type of agencies, Services offered by various agencies, Criteria for selecting the agencies and evaluation. Advertising copy, Advertising objectives and Budgeting: Goal setting – DAGMAR approach, various budgeting methods used, AIDA model.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercises: Student should study the ad agencies and services provided by them in detail.

Module 3 - Media Planning 08 Hours

Developing Media plan, Problems encountered, Media Evaluation Print, Broadcast media, Support media in advertising. Media strategy: Creativity, Elements of creative strategies and its implementation, Importance of Headline and body copy.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercises: Design a media planning for any product/service.

Module 4–Advertisement Monitoring, Evaluation and Control 08 Hours

Measurement in advertising, various methods used for evaluation, Pre-testing, Post testing.
International Advertising: Global environment in advertising, Decision areas in international advertising.**Internet advertising:** Meaning, Components, Advantages and Limitations, Types of Internet advertising.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercises: Visit an industry and analyze the overall operations.

Module 5 - Traditional & Digital Media in Advertising 08 Hours

Features, Functions, Growth, Advantages/ Disadvantages, And Direct Marketing Strategies. Promotion: Meaning, Importance, tools used, Conventional/unconventional, drawbacks, push pull strategies, Co-operative advertising, Integration with advertising and publicity Public relation/ Publicity:- Meaning, Objectives, tools of public relations, Public relation strategies, Goals of publicity, Corporate Advertising – Role, Types, Limitations, PR V/s Publicity. E- Commerce and Digital Media, Advertising on Digital Media, Social Media, Mobile Adverting, E-PR. Retailer Promotions-Consumer Promotions (Coupons, Rebates, and Loyalty Programs,
Online, and Special Event Promotions)

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercises: Case study on advertising and promotional strategies in business marketing.

Course Outcomes: At the end of the course the student will be able to:

CO1: Apply comprehensive IMC framework models and principles of advertising programme.
CO2: Evaluate the components of IMC for strategic advantage and effective advertising.
CO3: Analyze various components of IMC and make appropriate media planning.
CO4: Create and measure effective advertisement with strategic intent.
CO5: Design the advertising program by considering the global scenario using technology.

Assessment Details

Continuous Internal Evaluation(CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.

- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Advertising and Promotions IMC Perspectives	Belch and Belch	Tata McGraw Hill	9/e, 2012.
2	Advertising & Integrated Brand Promotion	O'Guinn, Allen, Semenik	Cenage Learning	New edition
Reference Books				
1	Integrated Advertising, Promotion, and Marketing Communications	Clow, Baack	Pearson Education, 2007.	3/e
2	Advertising an IMC perspective	S.N.Murthy& U Bhojanna	Excel Books	Latest edition
3	Sales Promotion: Concepts, Methods, and Strategies	Robert C. Blattberg& Scott A. Neslin	Prentice- Hall	Latest edition

Semester: IV

Course Name: Digital and Social Media Marketing

Course Code	**21MBAMM403**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Fundamentals of Digital and Social Media Marketing
- Basics of Marketing e-retailing
- Basics of E-Commerce

Module – 1: Introduction to digital marketing **8 Hours**

The Digital Marketing Framework, Need for Digital Marketing, Difference between Traditional Marketing and digitalMarketing,whatisdigitalmarketingstrategy,DigitalMarketingManager-Roleandfunctions, ROI between Digital and traditional marketing, understanding the current business, Basics of Internet, Types of Digital Marketing: E-mail Marketing, Social Media Marketing, Mobile Marketing, Influencer Marketing, Viral Marketing, Search Engine Marketing.

E-Marketing Plan: Overview of the E-Marketing Planning Process – Creating an E Marketing Plan– A Seven-Step E-Marketing Plan. The E-Marketing Environment: Overview of Global E-Marketing Issues – Country and Market Opportunity Analysis – Technological Readiness Influences Marketing – The Digital Divide Ethical and Legal Issues – Privacy – Digital Property–Cyber Crime-- Cyber Security.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.

Skill Enrichment Exercise: Students are asked to discuss of Privacy issue of digital marketing.

Module – 2: E-Marketing Research **8 Hours**

Definition and meaning of research. Data Drive Strategy – Marketing Knowledge Management –Monitoring Social Media – Technology-Enabled Approaches – Real-Space Approaches –Marketing Databases and Data Warehouses – Data Analysis and Distribution – Knowledge Management

Metrics - Consumer Behaviour Online – Segmentation – Targeting –Differentiation – Positioning Strategies. Data Analytics: Introduction, Key terms and concepts. Working with data. Setting objectives, goals and KPIs. Tracking and collecting data. Analyzing data. Advantages and challenges.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.

Skill Enrichment Exercise: Students are asked to discuss on Process of e-Marketing Research

Module – 3: Marketing Management **8 Hours**

Product – Products on Internet – Creating Customer Value Online– Product Benefits – E-Marketing Enhanced Product Development – Price – Change in Pricing Strategies – Buyer and Seller Perspectives – Payment Options – Pricing Strategies – Distribution–

Online Channel Intermediaries – Distribution Channel Length and Functions – Channel Management and Power – Distribution Channel Metrics. **Search Engine Optimization and Content Development:** Realistic Goal Setting, Keyword Search,Google Web master guidelines,Crawling and indexing, Pageranking, Google search console **Social Media**: Facebook Pages, Facebook Business Suite, Instagram Page, Linkedin Page, Twitter profile for your business, kooapp, WhatsApp Business **Content Development:** Choosing appropriate Images for the website, Important aspects to keep in mind for Content writing.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercise:** Students are asked to study on influence of social media

Module – 4: Customer Acquisition and Retention **8 Hours**

Profile of Consumers – Browsing Behaviour Model – Elements of Social Media – Social Media Strategies – Social Media Performance Metrics – Building Customer Relationships – Relationship Marketing – Stakeholders – Three Pillars of Relationship Marketing – Customer Relationship Management (CRM) – CRM Building Blocks – Ten rules for CRM Success.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercise: Case study on e-CRM**

Module – 5: Social Media Channels **8 Hours**

Introduction, Key terms and concepts, Traditional media Vs Social media. Social media channels: Social networking. Content creation, Bookmarking & aggregating and Location & social media. Tracking social media campaigns. Social media marketing: Rules of engagement. Advantages and challenges. Dealing with opportunities and threats. Step-by-step guide for recovering from an online brand attack. Social media risks and challenges. **Display Advertising:** meaning, Process, Goals, Search Advertising V/s display advertising, types of display advertising, Organising display advertising and Google Ads. **Video advertising and marketing**: strategic fit of video marketing, video content and budgeting, promoting videos, sharing videos, advertising on video sharing sites, Video marketing metrics.
Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercise:** Students are asked to discuss on different Social media channels.

Course Outcomes: At the end of the course the student will be able to:

CO1: Recognize appropriate digital marketing objectives.
CO2: Identify the role and implications of different Marketing Research.
CO3: Identifying about the SEO and online advertising.
CO4: Comprehend the role of E-CRM.
CO5: Analyze the role of Social media and its channels.

Assessment Details

CIE:

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Digital Marketing: Strategy, Implementation and Practice	Chaffey D & Ellis-Chadwick	Pearson publishers	5th Edition, 2012
2	E-Marketing	Judy Strauss and Raymond Frost	Prentice Hall	6th Edition, 2013
3	Internet Marketing: Integrating Online and Offline Strategies	M. L. Roberts and Debra Zahay,	Cengage Publishing	3rd edition, 2013
Reference Books				
1	E-Commerce: An Indian Perspective	P. T. Joseph	Prentice Hall,	4th edition
2	Up and out of poverty: the social marketing solution	Kotler, P. and Lee, N.	Pearson Education.	
3	How Social marketing works in Healthcare’	Evans	BMJ, BMJ Publishing Group Ltd.	2006,Edition

Semester: IV

Course Name: Strategic Brand Management

Course Code	**21MBAMM404**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Basic concepts of marketing.
- Understanding of branding concepts.
- Understanding of national & global brands of different marketeers.
- Knowledge of how branding can play a competitive advantage.

Module 1 - Introduction to the Concept of Brand Management 08 Hours

Brand –Meaning, Definition, Evolution of Brands, Functions of Brand to consumer, Role of Brand- Advantages of Brand, Product V/s Brand, Branding- Meaning, Creation of Brands through goods, services, people, Organization, Retail stores, places, online, entertainment, ideas, challenges to Brand builders Brand Management-Meaning & Definition. Strategic Brand Management Process-Meaning, Steps in Brand Management Process Strong Indian Brands.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercises: Choose various national and multinational brands and analyze its strategies.

Module 2 - Customer Based Brand Equity 08 Hours

Customer Based Brand Equity-Meaning, Model of CBBE Brand Equity: Meaning, Sources, Steps in Building Brands, Brand building blocks Resonance, Judgments, Feelings, performance, imagery, salience-Brand Building Implications, Brand Identity & Positioning: Meaning of Brand identity, Need for Identity & Positioning, Dimensions of brand identity, Brand identity prism, Brand positioning – Meaning, Point of parity & Point of difference, positioning guidelines Brand Value: Definition, Core Brand values, Brand mantras, Internal branding.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercises: Choose a failure brand analyze it and frame repositioning strategies.

Module 3 - Choosing Brand Elements to Build Brand Equity 08 Hours

Criteria for choosing brand elements, options & tactics for brand elements-Brand name, Naming guidelines, Naming procedure, Awareness, Brand Associations, Logos & Symbols & their benefits, Characters & Benefits, Slogans & Benefits, Packaging. Leveraging Brand Knowledge: Meaning of Brand Knowledge, Dimensions of Brand Knowledge, Meaning of Leveraging Secondary Brand Knowledge & Conceptualizing the leverage process.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercises: Case study on branding elements to create brand equity.

Module 4 - Designing and Sustaining Branding Strategies 08 Hours

Brand hierarchy, Branding strategy, Brand extension and brand transfer, Managing Brands overtime. Brand Architecture and brand consolidation. Brand Imitations: Meaning of Brand Imitation, Kinds of imitations, Factors affecting Brand Imitation, Imitation V/s Later market entry, First movers advantages, Free rider effects, Benefits for later entrants, Imitation Strategies, Brand extension.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercises: Choose a multinational company product and analyze the brand portfolio and brand extension for the same.

Module 5 – Luxury Brand Management & Making Global Branding 08 Hours

Geographic extension, sources of opportunities for global brand, single name to global brand, consumers & globalization, conditions favoring marketing, barriers to globalization, managerial blockages, organization for a global brand, pathways to globalization.
Luxury Brand Management: basic psychological phenomena associated with luxury purchase, luxury marketing mix.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercises: Students can choose 2 popular brands, identify & examine the criteria for success in luxury brand industry.

Course Outcomes: At the end of the course the student will be able to:

CO1: Apply the fundamental concepts of strategic brand management in the global scenario.
CO2: Analyze the role of brands, the concept of brand equity, and the advantages of creating strong brands.
CO3: Evaluate the elements of products, services and brand management and equity.
CO4: To develop familiarity and competence with strategies involved in building, leveraging and defending strong brands.
CO5: Design the strategies to enter into the global market with global brand and sustain.

Assessment Details

Continuous Internal Evaluation(CIE) :

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open

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- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Strategic Brand Management, Building Measuring & Managing Brand Equity	Kevin Lane Keller	Pearson Education	2nd Ed Phi
2	Brand Management - The Indian Context	Y L R Moorthi	Vikas Publication	New edition
Reference Books				
1	Strategic Brand Management	Jean, Noel, Kapferer	Kogan Page India	Latest edition
2	Strategic Brand Management	Richard Elliott & Larry Perclu	Oxford Press	1/e
3	Strategic Brand Management	Jean, Noel, Kapferer	Kogan Page India	Latest edition

Semester: IV

Course Name: Rural Marketing

Course Code	**21MBAMM405**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Awareness of rural markets.
- Understanding of rural and urban market consumer's psychology.
- Exposure to the rural markets products/services.
- Logical and reasoning ability to deal with rural consumers.

Module 1 - Introduction to Indian Rural Marketing 08 Hours

Definition, scope of rural marketing, concepts, classification of rural markets, rural vs. urban markets. Rural marketing environment: Population, occupation pattern, income generation, location of rural population, expenditure pattern, literacy level, land distribution, land use pattern, irrigation, development programs, infrastructure facilities, rural credit institutions, rural retail outlets, print media in rural areas, rural areas requirement, rural demand and rural market index, problems in rural marketing.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercises: List down all various government schemes and programs initiated for rural consumers.

Module 2 - Rural Consumer Behaviour 08 Hours

Consumer buying behaviour models, Factors affecting Consumer Behaviour, Social factors, Technological Factors, Economic Factors, Political Factors, Characteristics of Rural consumer- Age and Stages of the Life cycle, Occupation and Income, Economic circumstances, Lifestyle, Personality and Brand Belief, Information Search and pre-purchase Evaluation, Rise of Consumerism, Consumer Buying Process, Opinion Leadership Process, Diffusion of Innovation, Brand Loyalty, Rural Vs Urban Marketing.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercises: Visit to a nearby village and understand the market structure and functioning of rural markets.

Module 3 - Rural Marketing Strategies & Marketing of Agricultural Inputs 08 Hours

Selection of Markets - Product Strategy - Product mix Decisions – Competitive product strategies for rural markets.
Marketing of agricultural inputs: **Indian tractor industry:** Challenges for Indian tractor industry, factors suggesting better future prospects for tractor industry, marketing strategies for tractor industry.**Fertilizer industry in India:**Classification of fertilizer industry, Challenges for marketing of fertilizer industry, marketing strategies for fertilizer industry.

Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:**Rural India: A Promising Market Place-A Case Study

Module 4 - The Rural Pricing Strategies & Agricultural Product Marketing 08 Hours

Pricing strategy - pricing policies - innovative pricing methods for rural markets - promotion strategy - appropriate media - Designing right promotion mix – promotional campaigns.

Marketing Agricultural Products: Marketing of rural artisan products, Characteristics of Indian handicrafts industry, marketing strategies for the development of rural artisan sector.

Rural marketing of financial services: Challenges in marketing for banking services in rural, opportunities for banking in rural areas, marketing strategies for banking services.

Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:**Student should launch a new product designing the rural marketing mix.

Module 5 - Rural Distribution & Communication Strategy & Recent Trends08 Hours

Distribution - Logistics Management - Problems encountered - selection of appropriate channels.Rural media- Mass media, Non-Conventional Media, Personalized media.

Recent Trends in rural marketing:

E-Commerce: Importance of E-Commerce and Impact of E-Marketing on rural consumers, Concept of Digital Village, Role of Social Media in rural marketing.

Information Technology: Impact of IT in Agricultural Marketing, E-Chaupal applications, Project Shakti, Web-casting-online training and guidance to farmers.

Online Marketers: Role of Online Marketers, Growth and Challenges

Teaching-Learning Process:
Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercises:**Developing a Rural Market e-hub-The case study of e-Choupal

Course Outcomes: At the end of the course the student will be able to:

CO1: Apply the fundamental rural marketing concepts in the real world scenario.
CO2: Analyze the various characteristics of Indian rural markets consumers in comparison with urban economy.
CO3: Evaluate the roadblocks of Indian rural market and advocate solutions for the problems of rural markets.
CO4: Design the marketing agricultural inputs to be adopted by Indian companies for rural development.
CO5: Communicate the various distribution and communication strategies to be implemented for the success of any rural products/services brand.

Assessment Details

Continuous Internal Evaluation(CIE) :

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30

(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)
The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
		Textbooks		
1	Rural Marketing	PradeepKashyap& Siddhartha Raut	Biztantra	Latest Edition
2	Rural Marketing	GopalSwamy T.P	Vikas Publishing House	3/e
		Reference Books		
1	Rural Marketing	Mathur U. C	Excel Books	I/e
2	Rural Marketing	Krishnamacharyulu C. G &LalithaRamakrishnan	Pearson Education	Latest Edition
3	Agricultural Marketing In India	Acharya	Oxford I B H	Latest Edition

Semester: IV

Course Name: International Marketing Management

Course Code	**21MBAMM406**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Fundamentals of International Marketing Management
- Basics of Marketing
- Basics of E-Commerce

Module – 1: Introduction to Global Marketing **8 Hours**

The different meanings of 'global marketing' (globalization and glocalization) The meaning of the value chain in international marketing. The Importance of Global Marketing, Forces Affecting Global Integration and Global Marketing the Scope and Challenge of International Marketing.
Motives for firms going international; Three theories explaining firms' internationalization process.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercise: Students are asked to discuss on International Marketing Management and its challenges.

Module – 2: Product Decisions in Global Marketing **8 Hours**

Global Market segmentation, Assessing Market potential and choosing Target Markets, Targeting and Target Market strategy options, Positioning. Product decisions Standardization or adaptation of products, International service strategies, PLC and IPLC Product communication alternatives, Branding decisions (sensory branding) Environmental strategies 'Long tail' strategies

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercise: Students are asked to study on IPLC

Module – 3: Pricing Decisions in Global Market **8 Hours**

Global Pricing Objectives and Strategies; Factors influencing international pricing, Price escalation, Currency markets and pricing, dumping and antidumping,countertrade,Crudeoilpricedetermination,International logistics price determination, Tariffs, crypto currencies, International insurance management.

Teaching-Learning Process:

Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.
Skill Enrichment Exercise: Students are asked to visit a Manufacturing organization where products are exported.

Module – 4: Global Distribution Decision	**8 Hours**
Structure of the channel (intensive, selective and exclusive) Managing and controlling distribution channels Managing Logistics Most common export documents Transportation Internationalization of retailing Grey market. **Global Marketing Communications Decisions:** Global Advertising, Advertising Agencies: Organizations and Brands, Creating Global Advertising, Global Media Decisions, Public Relations and Publicity. Sales Promotion, Personal Selling, and Special Forms of Marketing.	
Teaching-Learning Process:	
Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercise:** Visit organization and meet marketing head and discuss about required sales skills.	

Module – 5: Export Documentations	**8 Hours**
ProForma Invoice, Customs Packing List. Country of Origin or COO Certificate. Commercial Invoice. Bill of exchange, Export License, Warehouse Receipt, Health Certificates, Bill of Entry, Import License, Insurance certificate, RCMC Registration cum Membership Certificate, GATT/DGFT declaration, Technical writeup, literature, Industrial License, Dangerous Goods certifications.	
Teaching-Learning Process:	
Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning. **Skill Enrichment Exercise:** Students are asked to discuss on Logistics Management and Procurement.	

Course Outcomes: At the end of the course the student will be able to:

CO1: Recognize the environment of international marketing management its process, theories and challenges.
CO2: Identify the role of product decisions in international marketing.
CO3: Identification of pricing decisions in global marketing.
CO4: Comprehend the role of global distribution and global marketing communication decisions
CO5: Analyze about logistics and procurement Management.

Assessment Details

CIE:

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based

learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	International marketing	Rakesh Mohan Joshi	Oxford	2004
2	International marketing	Michael Czinkota, Illka A. Ronkainen,	cenage Learning	2004
3	International Marketing	Caterora. P, Gilly .M & Graham. J	Tata McGraw-Hill Publications	2011,15thEdition
4	International marketing: analysis and strategy	Sak Onkvisit, John shaw	Biztantra	4/e
Reference Books				
1	Global Marketing	Hollensen, Svend	Pearson Education	7thEdition, 2017
2	Global Marketing Management	Warren J. Keegan & Mark C. Green	Pearson Education	9thEdition, 2018
3	International Marketing	Catero, Graham.	15/e, TMH	2012

Semester: IV

Course Name: Leadership & Building Organization

Course Code	**21MBAHR401**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Good communication & Presentation skills.
- Basic Knowledge of Leadership, Teams.
- Awareness of Self-Awareness, Self-Discipline, Leadership Development Program.
- Basic Concepts of Culture.

Module – 1 Introduction 4 Hours

Concept of Leadership, Ways of Conceptualizing Leadership, Definition and Components, Leadership Described, Trait Versus Process Leadership, Assigned Versus Emergent Leadership. Leadership and Power, Leadership and Coercion, Leadership and Management. Indian Business Leaders.

Teaching-Learning Process:

Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study**.**
Skill Enhancement Exercises: List out the traits of a successful leader from the top corporates

Module – 2 Leadership Approaches 8 Hours

Trait Approach: Intelligence, Self-Confidence, Determination, Integrity, Sociability, Five-Factor Personality Model and Leadership, Emotional Intelligence.
Skills Approach: Three-Skill Approach, Technical Skill, Human Skill, Conceptual Skill, Skills Model, Competencies, Individual Attributes, Leadership, Outcomes, Career Experiences, Environmental Influences.
Behavioral Approach: The Ohio State Studies, The University of Michigan Studies, Blake and Mouton's Managerial (Leadership) Grid, Authority–Compliance (9,1), Country-Club Management (1,9) Impoverished Management (1,1), Middle-of-the-Road Management (5,5), Team Management (9,9), Paternalism/Maternalism, Opportunism.
Situational Approach: Description, Leadership Styles, Development Levels.

Teaching-Learning Process:

Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study**.**
Skill Enhancement Exercises: Meet any Leader- Organization or Academic and ask 10 questions related to Leadership. Then analyze the type of leadership style adopted.

Module – 3 Leadership Theories 10 Hours

Path–Goal Theory: Leader Behaviors, Directive Leadership, Supportive Leadership, Participative Leadership, Achievement-Oriented Leadership, Follower Characteristics, Merits and Demerits
LMX Theory: Early Studies, Later Studies, Leadership Making, Merits and Demerits.
Transformational Leadership: Definition, Transformational Leadership and Charisma, A Model of Transformational Leadership, Transformational Leadership Factors, Transactional Leadership Factors, Non-leadership Factor, Other Transformational

Perspectives Bennis and Nanus, Kouzes and Posner. Merits and Demerits. **Authentic Leadership:** Definition, Approaches to Authentic Leadership, Practical Approach, Theoretical Approach, Merits and Demerits. **Psychodynamic Approach:** The Clinical Paradigm, History of the Psychodynamic Approach, Key Concepts and Dynamics Within the Psychodynamic Approach, Focus on the Inner Theatre, Focus on the Leader-Follower Relationships- Social Defense Mechanisms, Mirroring and Idealizing, Identification with the Aggressor. Focus on the Shadow Side of Leadership Narcissism. Merits and Demerits of Psychodynamic Approach.
Teaching-Learning Process:
Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study**.** **Skill Enhancement Exercises: Meet 4-5 Leaders from different roles and compare - contrast the different styles on leadership.**

Module – 4 Leadership Instrument 9 Hours

Culture Definition, Related Concepts, Ethnocentrism, Prejudice, Dimensions of Culture, Uncertainty Avoidance, Power Distance, Institutional Collectivism, In-Group, Collectivism, Gender Egalitarianism, Assertiveness, Future Orientation, Performance Orientation, Humane Orientation, Leadership Behavior and Culture, Clusters, Eastern Europe Leadership Profile, Latin America Leadership Profile, Latin Europe Leadership Profile, Confucian Asia Leadership Profile, Nordic Europe Leadership Profile, Anglo Leadership Profile, Sub-Saharan Africa Leadership Profile, Southern Asia Leadership Profile, Germanic Europe Leadership Profile, Middle East Leadership Profile, Universally Desirable and Undesirable Leadership Attributes.
Teaching-Learning Process:
Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study**.** **Skill Enhancement Exercises: Analyze a leadership profile of an international leader**

Module – 5 Ethical Leadership 9 Hours

Ethics Definition. 3 Levels- Preconventional Morality; Conventional Morality; Post conventional Morality; Ethical Theories, Centrality of Ethics to Leadership, Heifetz's Perspective on Ethical Leadership; Burns's Perspective on Ethical Leadership, The Dark Side of Leadership, Principles of Ethical Leadership, Ethical Leaders Respect Others, Ethical Leaders Serve Others, Ethical Leaders Are Just, Ethical Leaders Are Honest, Ethical Leaders Build Community. Case Studies on Ethical Leadership. **Leadership Code: Five Rules to lead** - Shape the Future, Make Things Happen, Engage Today's Talent, Build the Next Generation and Invest in Yourself. **Leadership and Crisis Management.**
Teaching-Learning Process:
Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study**.** **Skill Enhancement Exercises: Draft a list of expected ethical practices of an organization.**

Course Outcomes: At the end of the course the student will be able to:

CO1: Apply the fundamental concepts of leadership in an organization.
CO2: Apply the knowledge of leadership theories and traits in real world situations.
CO3: Analyze the impact of organizational leadership styles, theories and traits on the followers.
CO4: Evaluate the relationship between culture and leadership profile.

CO5: Design ethical leadership practices in an organization.

Assessment Details

Continuous Internal Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools (AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Leadership: Theory and Practices Leadership for Organisations	Peter G. Northouse	Sage Publication	7/e, 2016
2	Management: Leading People and Organisations in the 21st Century	Gary Dessler	Prentice Hall	2001
3	Charismatic Leadership in Organisations	Jay A. Conger, Rabindra N. Kanungo	Sage Publications	1998
Reference Books				
1	Leadership: Theory and Practice	Peter G. Northouse	Sage	2010
2	Management: Leading People and Organisations in the 21st Century	Gary Dessler	Prentice Hall	2001
3	The Leadership Code: Five Rules to Lead	Dave Ulrich, Norm Smallwood, Kate Sweetman	Harvard Business Pres	2008
4	Leadership for	David A. Waldman,	Sage Publications	2019

	Organisations	Charles O'Reilly		

Semester: IV

Course Name: Personal Growth and Interpersonal Effectiveness

Course Code	**21MBAHR402**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

1. Basic knowledge about personality traits
2. Familiarize with personality testing tools
3. Knowledge about individual behaviors

Module – 1 Introduction to Personal Growth 8 hours

Meaning, nature and scope of personal growth. Self-awareness and self-esteem, life roles, social roles and organisational roles, role clarity and role boundaries. Ego states-Id, ego and super ego and defense mechanism. Developing a self-improvement plan. **Interpersonal Trust:** Openness, confidentiality, blind spot and unknown part of personality. Self-disclosure, seeking feedback, self-reflection and practicing new behaviors. Discovering facets of interpersonal trust through Johari Window.

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars

Skill Enrichment Exercise: Take the test of Johari window and self assess on the behaviors

Module – 2 Understanding Human Personality and Neuro Functioning 8 Hours

Personality theories, Carl Jung's theory of personality types and Myers Briggs Type Indicator test (MBTI), Trait theories- Guilford Peogut, PF 16 and Type A and B, Emotional intelligence. Basic functions of mind: Creativity and innovation. Blocks to creativity. Creativity processes and tools- convergent and divergent thinking. Six thinking Hats, Neuro Linguistic Programming.

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars

Skill Enrichment Exercise: Self assessment on the individual Personality through MBTI test and make necessary changes

Module – 3 Self-Management and its Effectiveness 8 Hours

Personal change meaning, nature and requisites. Understanding Self-Management, Social adjustments and habit formation. Locus of control. Habits of personal effectiveness. Seven habits of highly effective people. Recent trends of self-management.

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars
Skill Enrichment Exercise: Study on the different attitudes of individual and the consequences of it.

Module – 4 Interpersonal Relations and Personal Growth 8 Hours

Interpersonal relations and personal growth: Interpersonal needs for openness, inclusion and control. Discovering the interpersonal orientation through FIRO-B. Conflict resolution and negotiation, time management and honoring the commitments

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars
Skill Enrichment Exercise: Understand the importance of interpersonal relations in workplace from employees

Module – 5 Transactional Analysis 8 Hours

Ego states, types of transactions and time structuring. Life position, scripts and games; T-group sensitivity training, encounter groups, appreciative enquiry and group relations conference (students may go through three days personal growth lab for experiential learning)

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars
Skill Enrichment Exercise: Experimental learning of individual through T-group sensitivity test

Course Outcomes:
CO1: Apply the various personality traits which promote personal growth of individual.
CO2: Analyze the concepts of human personality, behaviour and functioning of mind
CO3: Learn and apply the psychometrics tests in understanding the personality traits.
CO4: Develop the greater insight of self, and others through various theories and prepare the developmental plan for interpersonal effectiveness.
CO5: Demonstrate individual's ego state through T-group sensitivity training analysis.

Assessment Details

CIE:

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Organisational Behaviour: Human Behaviour at work	John W. Newstrom and Keith Davis	Tata McGraw Hill	11/e, 2003
2	Human Relations in organisations	Robert N. Lussier	Mc- Graw Hill Education	6/e
3	Development of Management Skills	Whetten & Cameron	PHI	7/e
4	Competency Mapping Assessment and Growth	Naik G. P	IIHRM	2010
Reference Books				
1	Understanding OB	Udai Pareek	Oxford University Press	
2	Theories of Personality	Calvin S Hall	Wiley India Pvt. Ltd	4/e
3	Seven habits of highly effective people	Stephen R Covey	Pocket Books.	
4	Training in interpersonal Skills	Stephen Robbins	Pearson Education	

Semester: IV

Course Name: International Human Resource Management

Course Code	**21MBAHR403**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

1. Knowledge on basic HR concepts
2. Familiarize with International HR issues
3. Knowledge on importance of Global HRM

Module – 1 Introduction To IHRM **8 Hours**

Meaning and Definition IHRM: Evolution, Challenges, Objectives, IHRM Versus Single Nation-centric HRM

IHRM: Approaches, Emergence of Global HR Manager, IHRM; Culture and Cross-Cultural Management , Positivist views: 'Culture and values' Interpretive views: 'Culture and meanings' Critical views: 'Culture and power"; Globalization and HRM, Approaches to International Human Resource Management , differentiating between PCNs, TCNs and HCNs

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars

Skill Enrichment Exercise: Discussion on affects of Globalization on Work environments

Module - 2 Managing Knowledge in Multinational Firms **8 Hours**

Introduction, Different types of knowledge, Factors influencing knowledge sharing How to stimulate knowledge sharing Gaining access to external knowledge, Knowledge retention From the management of knowledge to innovation

Training and Development: Domestic Versus International Organizations International Training Management: Basic Concepts and Models Leadership Training and Development in International Organizations, Technology in International Training Management.

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars

Skill Enrichment Exercise: Discussion on importance of Tacit Knowledge and its generation

Module – 3 Global Performance Management & Rewards **8 Hours**

Introduction, Key components of PMSs, Factors affecting PMSs, Culture and PMSs, Total Rewards in the International Context

The current state of total rewards, Complexities faced by IHR managers, International

total rewards objectives for the MNC, and Key components of global total rewards programs. Approaches to international compensation, Repatriation issues, and International trends in global total rewards.
Teaching-Learning Process:
Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars **Skill Enrichment Exercise:** Analyzing different components of PMS in MNCs

Module – 4 International Assignments and Employment Practices 8 Hours

Introduction, staffing policies, Motives for international transfers, Newer forms of international assignments, Alternative forms of international assignments. The international assignment process, Dimensions of international assignment success Importance of regulation and political context, Political and institutional drivers of de-regulation, Human Resource Management in Cross-Border Mergers and Acquisitions. Cultural differences and cross-border M&A performance, Managing cross-border integration: the HRM implications.
Teaching-Learning Process:
Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars **Skill Enrichment Exercise:** Discussion on affects of M&A on Human Resource

Module – 5 Diversity Management 8Hours

Equal opportunities, Diversity Management, International Culture Management: Model Organizational Culture and Innovation, Models of Culture, Hofstede's Four Cultural Dimensions, Trompenaar's Seven Cultural Dimensions, Globe's Nine Cultural Dimensions, Edgar Schein's Model of Culture , Deal and Kennedy's Culture Model, Schneider's Culture Model ; Profile of Organizational Culture in International Organizations Managing International Culture.
Teaching-Learning Process:
Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars **Skill Enrichment Exercise:** Analyzing affects of culture on the performance of Human capital

Course Outcomes: **CO1:** Apply conceptual knowledge and practical experience in understanding the HR concepts globally. **CO2:** Analyze and comprehend the strategic approaches of HR aspects amongst PCN's, TCN's and HCN's. **CO3:** Evaluate the knowledge of IHRM and apply the concepts in global perspective **CO4:** To have a better insight of HR policies and practices by critically analyzing the impact of contemporary issues globally.

CO5:	Elaborate the understanding on influence of culture on Global Work environments.

Assessment Details

CIE:

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

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- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	International Human Resource Management	Srinivas R. Kandula	Sage Publication India Pvt. Ltd.	2018
2	International Human Resource Management	Anne-Wil Harzing, Ashly H. Pinnington	Sage Publication India Pvt. Ltd.	4/e, 2015
3	Diversity at Work	Arthur P Brief	Cambridge University Press	2008
Reference Books				
1	Strategic Human Resource Management: An International Perspective	Gary Rees, Paul E. Smith	Sage Publication India Pvt. Ltd.	2014
2	Global Talent Management: An Integrated Approach	Sonal Minocha and Dean Hristov	Sage Publication India Pvt. Ltd.	2019
3	International Human Resource Management	Anne-Wil Harzing, Ashly Pinnington	Sage Publication India Pvt. Ltd.	2011

Semester: IV

Course Name: Public Relations

Course Code	**21MBAHR404**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Basic knowledge of public relations
- Basic Insights into relationship building and convincing skills
- Good communication & presentation skills
- Logical and observation skills
- Understanding internal and external environments of organization

Module – 1 Introduction to Public Relations **8 hours**

Meaning, Definition, Importance of Public Relations, Conceptual and Operational perspectives of PR, Specific functions of PR, Proactive & Reactive approaches; Public Relation Officer roles – Models of Public Relations; Public Relations process.

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars
Skill Enrichment Exercise: Analyze the role of PR department in different industries

Module – 2 Theoretical Understanding of Public Relations **8 Hours**

UNDERSTANDING THEORITICAL UNDERPINNINGS IN PR : Behavioral Public Relations Model – Persuasion Model – Two way symmetrical Communications Model; Theories of persuasion and social Influence; Theories of Mass communications and its applicability in PR

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars
Skill Enrichment Exercise: Practical orientation of theoretical aspects of different models in handling PR issues

Module – 3 Employee Relations **8 Hours**

Introduction, Types of Publics, Importance of Employee communication, Communication Policy, Organization Culture & Change, media of Employee communications, Rules for effective Employee Relations

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars
Skill Enrichment Exercise: Case studies on Effective means of communication adopted by organizations to motivate employees

Module – 4 Community and Media Relations	**8 Hours**
Community Relations- Need, Community Relations Process, Corporate Social Responsibility & Philanthropy; Media Relations – Media Relations –Role of Media in Public Relations – Social Media – working with the media –Media Relations Program Elements –Role of Technology in Public Relations.	
Teaching-Learning Process:	
Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars **Skill Enrichment Exercise:** Discussion on Influence of community and Media on PR decision making	

Module – 5 Crisis Management and PR	**8 Hours**
Public relations challenges, Types of Issues, Types of crisis, Crisis Management, People's reaction at the time of crisis, Role of Communication, Fundamental Guidelines	
Teaching-Learning Process:	
Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars **Skill Enrichment Exercise:** Discussion on the real time case on Crisis Management	

Course Outcomes:
CO1: Apply fundamental tools of Public Relations practices
CO2: Analyze various emerging trends in the field of Public Relations
CO3: Analyze the importance of Employee communication and Organization change
CO4: Evaluate the importance of Community & Media Relations
CO5: Create a fundamental guidelines of handling issues and crisis Management plan in the Organizations

Assessment Details

CIE:

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.

- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Public Relations The Profession and Practice"	Lattimore, Laskin, Heiman & Toth	Tata McGraw Hill	Third edition, , 2012 (LLHT)
2	"Public Relations Practices – Managerial Case Studies and Problems" Center, ,	Jackson, Smith and Stansbury	Prentice Hall of India	Seventh Edition, , 2008
3	Public Relations - Paul Baines,	John Egan, Frank Jefkins, Routledge	ISBN - 1136370773, 9781136370779	3rd edition, 2007,
Reference Books				
1	Strategic Planning for Public Relations,	Ronald D. Smith Taylor & Francis,	ISBN - 1135606080, 9781135606084	revised edition 2004
2	Public Relations: APractical Guide to the Basics, , ,	Philip Henslowe	Kogan Page Publishers, 2003, ISBN - 0749440724, 9780749440725	1st edition
3	Public Relations Practices, Managerial Case Studies and Problems, Allen H Center	Allen H Center, Patrick Jackson, Stacey Smith	Frank R Stansberry	7th Edition.

Semester: IV

Course Name: Compensation Management & Reward System

Course Code	**21MBAHR405**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

1. Basic knowledge on Compensation and rewards
2. Basic Knowledge on MS-Excel
3. Familiarize with salary concepts

Module – 1 Conceptual Frame work of Compensation **8 Hours**

Compensation, Meaning of compensation, Total Compensation/Reward and Its Components and Types,
Importance of the Total Compensation Approach, Wages/Salaries, Some Other Terms, Theories of Wages, Compensation Strategy, Compensation Policy, The Psychological Contract, Compensation and Legal Issues in Compensation Management, Factors Affecting Employee Compensation/Wage Rates/Wage Structure/Levels of Pay.

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars
Skill Enrichment Exercise: Study on the various terms of compensation used in organizations

Module – 2 Compensation Management **8 Hours**

Meaning of Compensation Management, Essentials of a Satisfactory Wage System, Types of Compensation Management - The Pay Model, Strategic Pay Policies, Strategic Perspectives of Pay, Strategic Pay Decisions, Best Practices vs. Best Fit Options, National Wage Policy in India, Wage Problems in India Divergent Systems and Institutions for Wage Fixation in India.

Teaching-Learning Process:

Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars
Skill Enrichment Exercise: Find out the revised wage policies of India for various sectors.

Module – 3 Wage Determination Practices in India **8 Hours**

Introduction, Management's Strategy, Reward Policy, Reward Management Processes, Reward Management Procedures, Pay Reviews, Planning and Implementing Pay Reviews, Procedures for Grading Jobs and Pay, Rates Fixation, Controlling Payroll Costs, Evaluation of Reward Processes, Some Other Trends, Boardroom Pay, Management Strategy; Fringe Benefits, Fringe Benefits and Current Practices, Internal Audit of Compensation and Benefits; Different types of Direct and Indirect compensation include: Base Pay / Base pay; Commissions; Overtime Pay; Bonuses, Profit Sharing, Merit Pay; Stock Options; Travel/Meal/Housing Allowance; Benefits including: dental, insurance, medical, vacation, leaves, retirement, taxes; Merit pay; Incentive Pay;

Deferred Pay ; Pay for time; Recreational facilities.
Teaching-Learning Process:
Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars **Skill Enrichment Exercise:** Overview on the types of pay in different organizations

Module – 4 Contingent Pay, Pay for Performance, Competence 8 Hours

Competency-Based Pay, Skill-Based Pay, Team-Based Rewards, Gainsharing, Profit-Sharing Profit-Related Pay and Beyond Other Cash Payments and Allowances Overtime Payments Attendance Bonuses, Shift Pay, Clothing Allowances, Honoraria, Payments for Qualifications, Pay for Person, Pay for Excellence, Managerial Compensation and Rewards, Sales Force Incentive Programmes, Competency based Pay- Framework, Model and Challenges; Pay for Performance : Steps involved in the design for pay for performance - Intent ; Eligibility; Participation
Teaching-Learning Process:
Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars **Skill Enrichment Exercise:** Gather information on competence based pay from various organizations

Module – 5 Administration & Controlling Salary Costs and Salary Review 8 Hours

Salary Survey data, Salary Costs, Salary Planning, Salary Budget, Salary Control, Salary Reviews, Guidelines for Salary Review Process, Responding to Negative Salary Review, Five Key Steps: Manager's Guide to Annual Salary Review, Fixing of Salary, Method of Paying Salary, Flexibility, Process of Wage and Salary Fixation.
Teaching-Learning Process:
Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars **Skill Enrichment Exercise:** Study on the administration of salary concepts from any managers in the organizations

Course Outcomes:

CO1: Apply various conceptual aspects of Compensation and Benefits to achieve organizational goals.
CO2: Analyze the strategic perspectives of pay for business excellence.
CO3: Evaluate wage determination practices in organizations in framing wage structure.
CO4: Designing the compensation strategies for attraction, motivation and retaining high quality workforce.
CO5: Communicate Legal & Administrative Issues in global compensation to prepare compensation plan, CTC, wage survey and calculate various bonus.

Assessment Details

CIE:

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Compensation Management	R. C. Sharma, Sulabh	Sage Publication India Pvt. Ltd	2019
2	Compensation and Benefit Design	Biswas, Bashker, D	Pearson	2013
3	Understanding wage systems in India	Sharma,A .M	Himalaya Publishing House	2009
Reference Books				
1	Human Resource Information Systems: Basics, Applications, and Future Directions	Michael J. Kavanagh, Mohan Thite, Richard D. Johnson	Sage Publication India Pvt. Ltd	3/e, 2015
2	Competency-Based Human Resource Management	Anindya Basu Roy, Sumati Raym	Sage Publication India Pvt. Ltd	2019
3	Compensation and Reward Management	Singh, B D	Excel Books	2007

Semester: IV

Course Name: Talent Management

Course Code	**21MBAHR406**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:2**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Hours of Pedagogy	**40**	**Max Marks**	**100**

Pre-requisites:

- Good communication & Presentation skills.
- Awareness of Performance Analysis Tools.
- Basics of HR functions.
- Awareness of Career Management and Succession Planning.

Module – 1 Talent Management – Introduction 8 Hours

Talent- Engine of New Economy, Difference between Talents and Knowledge Workers, Leveraging Talent, The Talent Value Chain, Elements of Talent Friendly Organizations, Talent Management Process, Talent Management System – Components and Benefits of Talent Management System; Creating TMS, Challenges of TMS, Building Blocks of Talent Management. Competencies – Performance Management, Conducting Performance Reviews, Appraising Executive Talent, Selecting The Right Appraisal.

Teaching-Learning Process:

Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.
Skill Enhancement Exercises: Discuss Top 5 Talent Friendly Organizations

Module – 2 Talent Planning 8 Hours

Concept, Succession Management Process, Integrating Succession Planning and Career Planning, Designing Succession Planning Program, Strategic Accountability Approach in Developing the Workforce, Balanced Scorecard, Talent Development Budget, Contingency Plan for Talent, Building a Reservoir of Talent, Compensation Management within the Context of Talent Management, CEO Succession Planning.

Teaching-Learning Process:

Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.
Skill Enhancement Exercises: Draft a Succession Planning for CEO

Module – 3 Talent Development and Retention 8 Hours

Potential Identification and Development. Coaching for Sustained &Desired Change, Integrating Coaching, Training and Development with Talent Management, Employee Retention- Motivation and Engagement. Returnon Talent, Age of Analytics, Making Outplacement as a part of Talent Strategy, Developing Talent Management Information System.

Teaching-Learning Process:

Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.
Skill Enhancement Exercises: List out the Employee Retention Strategies implemented by top Corporates

Module – 4 Competency Mapping 8 Hours

Concepts and Definition of Competency; Types of Competencies, Competency based HR Systems, Competency and Performance, 5 Level Competency Model, Developing Various Competency Models, How Competencies Relate to Career Development and Organizational Goals.

Teaching-Learning Process:
Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study. **Skill Enhancement Exercises: Prepare an Employee Career Development Program for an automobile company.**

Module – 5 Performance Assessment 8 Hours

Competency Mapping & Performance Assessment: Meaning, Definition, Background and Approaches to Performance Assessment, Competency based Performance Assessment, Diagnosing Reasons for Performance Problems, Designing an Effective Performance Management System, Sources of Errors in Performance Measurement. Assessments Centre: Concepts, Importance and Uses of Assessments Centre in Selecting Employees, Assessment Centre Approach to Competence Building.
Teaching-Learning Process:
Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study. **Skill Enhancement Exercises: Prepare a Competency Dictionary for various positions**

Course Outcomes: At the end of the course the student will be able to:

CO1: Apply the basics of TMS to formulate HR policies and practices in corporate sector.
CO2: Analyze various strategies for developing and retaining best talents for competitive advantage of the organization.
CO3: Evaluate various competency models to relate career development and organizational goals.
CO4: Analyze various methods of competency mapping to evaluate a person's ability.
CO5: Develop competency based performance management system.

Assessment Details

Continuous Internal Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools (AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

SEE: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

SN	Title of the Book	Name of the	Name of the	Edition and

		Author/s	Publisher	Year
Textbooks				
1	Organizational Behaviour: Human Behavior at work	– John W. Newstrom and Keith Davis,	Tata McGraw Hill	11/e,2003.
2	Human Relations in organizations	Robert N. Lussier,	Mc-Graw Hill Education.	6/e
3	Development of Management Skills	Whetten & Cameron,	PHI.	7/e
Reference Books				
1	Understanding OB	UdaiPareek,	Oxford University Press.	
2	Theories of Personality	Calvin S Hall	Wiley India Pvt. Ltd.	4/e
3	Seven habits of highly effective people	Stephen R Covey	Pocket Books	

GUIDELINES FOR 6 WEEK PROJECT WORK
20MBAPR407(BETWEEN 3RD AND 4TH SEMESTER MBA)

Course Code	**21MBAPR407**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**0:0:16**	**SEE Marks**	**50**
Credits	**08**	**Exam Hours**	**00**

Objective

To expose the students to understand the working of the organization/company / industry and take upan in- depth study of an issue / problem in the area of specialization.

General Guidelines

- The project work shall be for a period of 6 weeks immediately after the completion of 3rd SEE butbefore the commencement of the 4th semester classes.
- The Course code of the project report shall be **21MBAPR407** and shall be compulsory for all thestudents opting for all specializations.
- The University shall receive 2 copies of project reports prior to the commencement of the 4th semester examination. Copies of the project report should be sent to the concerned COE Office, Ballari Institute of Technology and Management, Ballari with intimation to the COE.
- By keeping the business trend in the present scenario, university has given an option to the students to select the research problem either from business organization or they can carry out the project on freelance basis subject to the approval of department committee.
- It is the total responsibility of the internal guide to monitor the freelance project.
- In case, business problem selected from a Company, no two students of an institute shall work onthe same problem in the same organization.
- The student shall seek the guidance of the internal guide on a continuous basis, and the guide shall give a certificate to the effect that the candidate has worked satisfactorily under his/her guidance.
- On completion of the project work, student shall prepare a report with the following format.
- The Project report shall be prepared using word processor viz. MS Word with New TimesRoman, 12 font size.
- All the reports shall be printed in the A4 size 1” margin on all the sides.
- The report shall be hard bound facing sheet of royal blue color indicating the title of college and month &year of admission (spiral binding not permitted).
- A certificate by the guide, HOD and Head of the institution indicating the bonafide performance of the project by the student to be enclosed.
- An undertaking by the student to the effect that the work is independently carried out by him/her.
- The certificate from the organization if applicable (if its Freelance project, certificate is not required and internal guide can issue a certificate for successful completion).
- Acknowledgement
- Executive Summary.

Schedule to be followed before commencement of Project		
Activity	**Timeline**	**Remarks**
Identifying the organization Problem identification	First week	Student individually identifies an organization OR identifies Problem for his/her study, according to his/her interest.
Problem statement Research Design	Second week	His/ Her interests are discussed with project guides. Discussion with Internal Guide to decide on suitable design for the research
Synopsis Preparation	Third week	Preparation of Synopsis* & formulating the objectives
Presentation of Synopsis	Fourth Week	The student will present the synopsis with the detailed execution plan to the Internal Guide and HOD who will review and may: a. Approve b. Approve with modification or c. Reject for fresh synopsis
Approval Status	Fifth & Sixth week	The approval status is submitted to HOD who will officially give concurrence for the execution of the Project

***Synopsis: Three page hard copy to be submitted to the HOD with the signatures of the Guide and the student**

Page 1	Title, Contact Address of student- with details of Internal and External Guide (if applicable).
Page 2	Short introduction with objectives and summary (300 words). Review of Articles / Literature about the topic with source of information.
Page 3	Time Activity Chart.

Schedule to be followed during Project work

Activity	Time Line	Remarks
Understanding Structure, Culture and functions of the organization /identifying of business problem from the Industry from the literature study	First week of Project	Student should understand products/services and theproblems of the organization.
Preparation of Research design and Research instrument for data collection	2nd week of Project	Discussion with the guide for finalization of research design and instrument in his/her domain and present the same to the guide. (First Presentation).
Data collection	3rd week of Project	Date collected to be edited, coded, tabulated and presented to the guide for suggestions for analysis. (Second Presentation).
Analysis and finalization of report	4th & 5th week of project	Students must use appropriate and latest statistical tools and techniques for analyzing the data. (It is must to use of Statistical Package whose result should be shown in the report) (Third Presentation).
Submission of Report	6th week of Project	Final Report should be submitted to the University before one week of the commencement of theoryexamination.

Project Report Evaluation:

- Internal evaluation will be done by the internal guide.
- External valuation shall be done by a faculty member of other institute drawn from other institutes with minimum of 10 years experience.
- Viva-Voce / Presentation: A viva-voce examination shall be conducted at the respective Institution where a student is expected to give a presentation of his/ her work.
- The viva –voce examination will be conducted by the respective HOD / Senior Professor of the department and an expert drawn from the other institutes with minimum of 10 years of experience as appointed by the University.
- Project work carries 100 marks consisting of 40 marks for internal marks by the internal guide, average of 30 marks from both internal and external evaluation and 30 marks for viva-voce examination. Minimum passing marks of the Project work is 50% in each of the components suchas Internal Marks, report evaluation and viva-voce examination.
- Format of the project report shall be prepared using the word processor viz., MS Word, Times New Roman font sized 12, on a page layout of A4 size with 1inch margin all sides (1.5inch on leftside) and 1.5 line spacing. The Project report shall not exceed 100 pages.
- Submission of Report: Students should submit the Project Report in electronic data form only, in PDF file (Un-editable Format) to the Institute. The Institute in turn shall submit all the CD's of their students along with a consolidated master list as per specialization containing USN, Name of the student, and Title of the Report to COE) one week before the commencement of the Theory Examinations or as per notification given for this purpose.
- Plagiarism: Plagiarism is considered as academically fraudulent, and an offence against University academic discipline. The University considers plagiarism to be a major offence, and subject to the corrective procedures. It is compulsory for the student to get the plagiarism check done before submission of the project report. Plagiarism of up to 25% is allowed in the project work and report should consist 75% of original content/work.
- Publication of Research Findings: Students are expected to present their research findings in Seminars/ Conferences/ Technical/ Management Fests or publish their research work in Journals in association with their Internal Guide. Appropriate Weightage should be given to this in the internal evaluation as well as in the viva voce examination of the project report.

Contents of the Project Report

- Cover page
- Certificate from the Organization (scanned copy if applicable)
- Certificate from the guide, HOD and Head of the Institution (scanned copy) indicatingbonafide performance of Project by the student
- Declaration by the student (scanned copy)
- Acknowledgement
- Table of contents
- List of tables and graphs
- Executive summary

Chapter 1: Introduction

Introduction, Industry profile and company profile: Promoters, vision, Mission & Quality Policy. Products / services profile areas of operation, infrastructure facilities, competitor's information, SWOT Analysis, Future growth and prospects and Financial Statement

Chapter 2: Conceptual background and Literature review

Theoretical background of the study, Literature review with research gap (with minimum 20 literature reviews).

Chapter 3: Research Design

Statement of the problem, Need for the study, Objectives, Scope of the study, Research methodology, Hypotheses,Limitations, Chapter scheme.

Chapter 4: Analysis and Interpretation

Analysis and interpretation of the data- collected with relevant tables and graphs. Results obtained bythe using statistical tools must be included.

Chapter 5: Findings, Conclusion and Suggestions

Summary of findings, Conclusion and Suggestions / Recommendations **Bibliography:** Books, Articles names, etc. to bementioned as per APA style. **Annexure:** Relevant to the project suchas figures, graphs, photographs etc.

Rubrics for Project Work (Common to core and Dual Specializations)

Sl. No	**Particulars**	**Marks Allotted**
1	Internal Assessment by the Guide- Based on threePresentations by Students	**25**
2	Report Evaluation by the Guide & External Examiner AverageOf the marks awarded by the two Examiners shall be the Final evaluation marks for the Dissertation.	**25**
3	Viva-Voce Examination to be conducted by the Guide andan External examiner from the Industry/ Institute (Joint Evaluation)	**50**
Total		**100**

Rubrics for Project Evaluation and Viva voce Examination

A. Internal Assessment by the Guide- Based on three Presentations by Students

SL No	Aspects	Marks Allotted
1	Introduction and Methodology	5
2	Industry and Company Profile	5
3	Theoretical background of study	5
4	Data analysis and interpretation	5
5	Summary of findings, suggestions and conclusion	5
	Total	25

A. **Report Evaluation by the Guide & External Examiner. Average of the marks awarded bythe two Examiners shall be the final evaluation marks for the Dissertation.**

SL No	Aspects	Marks Allotted
1	Introduction & Relevance of the project	5
2	Conceptual background and literature review	5
3	Research design	5
4	Analysis and interpretation	5
5	Summary of findings, suggestions and conclusion	5
	Total	**25**

B. **Viva-Voce Examination to be conducted by the HOD/ Guide and an External examiner fromthe Industry/ Institute (Joint Evaluation)**

SL No	Aspects	Marks Allotted
1	Presentation skills	5
2	Communication skills	5
3	Subject knowledge	10
4	Objectives of the study and Methodology	10
5	Analysis using statistical tools and statistical packages	10
6	Findings and appropriate suggestions	10
	Total	**50**

Formats for Project Report and Evaluation

- Format of Cover Page
- Format of certificate by Company/Institution or from both
- Format of Declaration Page
- Format of Contents
- Format of List of Tables and Charts
- Format of Bibliography
- Format for Internal Evaluation, External Evaluation and Viva voce

(Title of the Report)

Submitted by

(Student Name)

(USN)

Submitted to

Ballari Institute of Technology and Management, Ballari
In partial fulfillment of the requirements for the award of the degree of

MASTER OF BUSINESS ADMINISTRATION

Under the guidance of

INTERNAL GUIDE | **EXTERNAL GUIDE**

(Name & Designation) | **(Name & Designation)(Institute Logo)**

Department of MBA

(Institute Name with Address)(Month & Year of submission)

CERTIFICATE

This is to certify that (Name of the Student) bearing USN (xxxx), is a bonafide student of Master of Business Administration Programme of Ballari Institute of Technology and Management, (Autonomous Under Visvesvaraya Technological University).Project report on “(Title of Report)”is prepared by Him/her under the guidance of (Name of the Guide), in partial fulfillment of the requirements for the award of the degree of Master of Business Administration

Signature of Internal Guide **Signature of HOD** **Signature of Principal**

DECLARATION

I, (Student Name), hereby declare that the Project report entitled “(Title)” with reference to —(Organization with place) prepared by me under the guidance of (Guide Name), faculty of M.B.A Department, (Institute name) and external assistance by (External Guide Name, Designation and Organization). I also declare that this Project work is towards the partial fulfillment of the university Regulations for the award of degree of Master of Business Administration by Ballari Institute of Technology and Management, Ballari (Autonomous under VTU). I have undergone a summer project for a period of Twelve weeks. I further declare that this Project is based on the original study undertaken by me and has not been submitted for the award of any degree/diploma from any other University / Institution.

Place: **Signature of the Student**

Date:

Table of Contents

Sl.No	Contents	Page No's.
Executive Summary		
Chapter-1	Introduction	**XXXXXXXX X**
Chapter-2	Industry and Company profile	**XXXXXXXX X**
Chapter-3	Theoretical Background of the Study	**XXXXXXXX X**
Chapter-4	Data Analysis and interpretation	**XXXXXXXX X**
Chapter-5	Summary of Findings, suggestions and Conclusion	**XXXXXXXX X**
Bibliography		
Annexures		

List of Tables

Sl.No	Particulars	Page No's.
1	Table showing ABC Analysis	XXXXX
2	Table showing FSN Analysis	XXXXX
3	Table showing EOQ	XXXXX
4	Table showing stock of Raw materials	XXXXX

List of Figures/ Charts/ Graphs

Sl.No	Particulars	Page No's.
1	Graph showing ABC Analysis	XXXXX
2	Graph showing FSN Analysis	XXXXX
3	Graph showing EOQ	XXXXX
4	Graph showing stock of Raw materials	XXXXX

BIBLIOGRAPHY

BOOKS :

Name of the Author, Title of the Book, Name of the Publisher, Edition, year of Publication.

ARTICLES:

Name of the Author, Title of the article, Name of the Journal, Volume/Issue Number, Year, Page Number (pp).

WEBLIOGRAPHY

Name of the Author, Title of the article. Retrieved on dd/mm/yyyy from URL

MARKS SHEET FORMATS

1. Internal Assessment by the Guide- Based on three Presentations by Students

Ballari Institute of Technology and Management, Ballari (Autonomous under VTU).

Marks Sheet for MBA Project Work (21MBAPR407)

Name of the College: **College Code:**

Internal Marks Allocation for Project Work (21MBAPR407)

SL No	Aspects	Marks Allotted
1	Introduction and Methodology	5
2	Industry and Company Profile	5
3	Theoretical background of study	5
4	Data analysis and interpretation	5
5	Summary of findings, suggestions and conclusion	5
	Total	**25**

Marks Sheet

Sl.No	USN	1	2	3	4	5	Total
1							
2							
3							
4							
5							

Signature of the Internal Guide with Name, Address & Date

Note:

1. Total Internal Evaluation Marks of the Project report should be sent along with the other subject internal marks and the above marks sheet should be maintained by the Department/Institution for verification on demand.
2. Total Internal Evaluation Marks of the Project report should be uploaded to COE Office by the Internal guide after thorough evaluation of the project report and the copy of the mark sheet downloaded after the entry must be maintained in the department as well as sent to COE Office along with the remuneration bill.

2. Report Evaluation by the Guide & External Examiner. Average of the marks awarded by the two Examiners shall be the final evaluation marks for the Dissertation.

Ballari Institute of Technology and Management, Ballari (Autonomous under VTU).

Marks Sheet for MBA Project Work (21MBAPR407)

Name of the College: **College Code:**
External Evaluation Marks Allocation for Project Work (21MBAPR407)

SL No	Aspects	Marks Allotted
1	Introduction & Relevance of the project	5
2	Conceptual background and literature review	5
3	Research design	5
4	Analysis and interpretation	5
5	Summary of findings, suggestions and conclusion	5
	Total	**25**

Marks Sheet

Sl.No	USN	1	2	3	4	5	Total
1							
2							
3							
4							
5							

Signature of External Examiner with affiliation

Note:
1. Total External Evaluation Marks of the Project report should be uploaded to COE Office by the External examiner appointed by COE Office after thorough evaluation of the project report and the copy of the mark sheet downloaded after the entry must be sent to COE Office along with the remuneration bill.
<u>**3. Viva-Voce Examination to be conducted by the HOD/ Guide and an External examiner from theIndustry/Institute (Joint Evaluation)**</u>

Ballari Institute Of Technology and

Management,Ballari(Autonomous Under VTU)

Marks Sheet for MBA Project Work (21MBAPR407)

Name of the College: **College Code:**
Viva voce Marks Allocation for Project Work (21MBAPR407)

(Viva voce conducted by HOD/Internal Guide and an Expert from other institutes.)

SL No	Aspects	Marks Allotted
1	Presentation skills	5
2	Communication skills	5
3	Subject knowledge	10
4	Objectives of the study and Methodology	10
5	Analysis using statistical tools and statistical packages	10
6	Findings and appropriate suggestions	10
	Total	**50**

Marks Sheet

Sl. No	USN	1	2	3	4	5	6	Total
1								
2								
3								
4								
5								

Signature of Internal Exam **Signature of External Examiner with affiliation**

Note: Marks may be finalized based on the joint evaluation by internal examiner and External examiner.

ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ

"ವಿಟಿಯು ಅಧಿನಿಯಮ ೧೯೯೪"ರ ಅಡಿಯಲ್ಲಿ ಕರ್ನಾಟಕ ಸರ್ಕಾರದಿಂದ ಸ್ಥಾಪಿತವಾದ ರಾಜ್ಯ ವಿಶ್ವವಿದ್ಯಾಲಯ

"ಜ್ಞಾನ ಸಂಗಮ", ಬೆಳಗಾವಿ-೫೯೦೦೧೮, ಕರ್ನಾಟಕ, ಭಾರತ

Visvesvaraya Technological University

(State University of Government of Karnataka Established as per the VTU Act, 1994)

"Jnana Sangama" Belagavi-590018, Karnataka, India

Phone: (0831) 2498100, Fax: (0831) 2405467, Website: vtu.ac.in

Dr. A. S. Deshpande B.E., M.Tech., Ph.D.
Registrar

Phone: (0831) 2498100
Fax: (0831) 2405467

Ref: VTU/BGM/BOS/A9/2021-22 / 3991 Date: 03 DEC 2021

CIRCULAR

Subject: 1st and 2nd -semester scheme(2021) of Teaching and Examinations regarding...

Reference: Hon'ble Vice-Chancellor's approval dated: 03.12.2021

The courses, 21IDT19- Innovation and Design Thinking (offered in 1st semester both for chemistry and physics groups) and 21SFH29- Scientific Foundations of Health (offered in 2nd semester both for chemistry and physics group) are compulsory courses for the students admitting to 1st year B.E./B.Tech. programs.

A slight modification is made in the scheme of teaching and examinations to offer both the courses in 1st as well as 2ndsemester for 50:50 strength of intake. The scheme is attached with this circular for reference and needful. Also, 3-8 semesters scheme template has been attached for stakeholder's information.

All the principals of Engineering Colleges are hereby informed to bring the content of this circular to the notice of the concerned. Please note: corrected scheme of programs is made available @ **https://vtu.ac.in/en/b-e-scheme-syllabus/#menu05**

Sd/-

Registrar

Encl: As mentioned above.

To,

- All the Principals of the Engineering Colleges under the ambit of VTU Belagavi.

Copy to:

1. The Hon'ble Vice-Chancellor through the secretary to VC for information
2. The Registrar(Evaluation) for information and needful
3. The Registrar's Office, VTU, Belagavi, for information.
4. The Special Officer, Academic Section, VTU Belagavi, for information.
5. The Director ITI SMU CNC for information and to upload the circular on the VTU web portal

REGISTRAR

Visvesvaraya Technological University, Belagavi
Scheme of Teaching and Examinations 2021
Outcome-Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021 – 22)

I Semester (Physics Group) **[Common to all B.E./B.Tech. Programs]**

Sl. No	Course and Course Code		Course Title	Teaching Department (TD)and Paper Setting Board(PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self-Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	BSC	21MAT11	**Calculus & Differential Equations**	TD and PSB: Mathematics	2	2	--		03	50	50	100	3
2	BSC	21PHY12	Engineering Physics	TD and PSB: Physics	2	2	--		03	50	50	100	3
3	ESC	21ELE13	Basic Electrical Engineering	TD and PSB: E and E Engineering	2	2	--		03	50	50	100	3
4	ESC	21CIV14	Elements of Civil Engineering and Mechanics	TD and PSB: Civil Engineering	3	--	--		03	50	50	100	3
5	ESC	21EVN 15	Engineering Visualization	TD: ME, Auto, IP, IEM, Mfg. Engineering PSB: Mechanical Engg	2	--	2		03	50	50	100	3
6	BSC	21PHYL16	Engineering Physics Laboratory	TD and PSB: Physics	--	--	2		03	50	50	100	1
7	ESC	21ELEL17	Basic Electrical Engineering Laboratory	TD and PSB: E and E Engineering	--	--	2		03	50	50	100	1
8	HSMC	21EGH18	Communicative English	TD and PSB: Humanities	1	1	1		02	50	50	100	2
9	AEC	21IDT19/29	Innovation and Design Thinking	Any Engineering Department	1	--	--		01	50	50	100	1
		OR											
		21SFH19/29	Scientific Foundations of Health										
				TOTAL	**13**	**07**	**07**		**24**	**450**	**450**	**900**	**20**

Note: BSC: Basic Science Course, **ESC**: Engineering Science Course, **HSMC**: Humanity and Social Science & Management Courses, **AEC** –Ability Enhancement Courses.

L –Lecture, **T** – Tutorial, **P-** Practical/ Drawing, **S** – Self Study Component, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Examination	
Credit definition: 1hour Lecture **(L)** per week = **1 Credit** 2 hours Tutorial **(T)** per week = **1 Credit** 2 hours Practical /Drawing (P) per week = **1 Credit**	(a) **Four-credit** courses are to be designed for **50** hours of Teaching-Learning process. (b) **Three credit** courses are to be designed for **40** hours of Teaching-Learning process. (c) **Two credit** courses are to be designed for **25** hours of Teaching-Learning process. (d) **One-credit** courses are to be designed for **15** hours of Teaching-Learning process.

AICTE Activity Points to be earned by students admitted to BE/B.Tech., /B.Plan day college programme (For more details refer to Chapter 6,AICTE Activity Point Programme, Model Internship Guidelines):

Over and above the academic grades, every Day College regular student admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE ActivityPoint Programme. Students transferred from other Universities to the fifth semester are required to earn 50 Activity Points from the year of entry toVTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card.

The activities can be spread over the years, anytime during the semester weekends and holidays, as per the liking and convenience of the student from the year of entry to the programme. However, the minimum hours' requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression.

In case students fail to earn the prescribed activity Points, an Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

Summer Internship - I (21INT36): All the students admitted to engineering programmes shall have to undergo a mandatory summer internship of **03 weeks** during the intervening vacation of II and III semesters. Summer Internship shall include Inter / Intra Institutional activities. A University Viva-voce examination (Presentation followed by question-answer session) shall be conducted during III semester and the prescribed credit shall be included in III semester. The internship shall be consideredas a head of passing and shall be considered for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements. (The faculty coordinator or mentor has to monitor the students' internship progress and interact to guide them for the successful completion of the internship.)

Visvesvaraya Technological University, Belagavi
Scheme of Teaching and Examinations 2021
Outcome-Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021 – 22)

II Semester (For students who attended I semester under Physics Group) **[Common to all B.E./B.Tech Programs]**

Sl. No	Course and Course Code		Course Title	Teaching Department(TD) and Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self-Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	BSC	21MAT21	Advanced Calculus and Numerical Methods	TD and PSB: Mathematics	2	2	--		03	50	50	100	3
2	BSC	21CHE22	Engineering Chemistry	TD and PSB: Chemistry	2	2	--		03	50	50	100	3
3	ESC	21PSP23	Problem-Solving through Programming	TD and PSB: Computer Science and Engineering	2	2	--		03	50	50	100	3
4	ESC	21ELN24	Basic Electronics & Communication Engineering	TD: ECE/E and I/ TC PSB: ECE	2	2	--		03	50	50	100	3
5	ESC	21EME25	Elements of Mechanical Engineering	TD: ME, Auto, IP,IEM, Mfg . Engineering PSB: Mechanical Engg	2	--	2		03	50	50	100	3
6	BSC	21CHEL26	Engineering Chemistry Laboratory	TD and PSB: Chemistry	--	--	2		03	50	50	100	1
7	ESC	21CPL27	Computer Programming Laboratory	TD and PSB: Computer Science and Engineering	--	--	2		03	50	50	100	1
8	HSMC	21EGH28	Professional Writing Skills in English	TD and PSB: Humanities	1	1	1		02	50	50	100	2
9	AEC	21SFH19/29	Scientific Foundations of Health	Any Department	1	--	--		01	50	50	100	1
		OR											
		21IDT19/29	Innovation and Design Thinking										
				TOTAL	**13**	**09**	**07**		**24**	**450**	**450**	**900**	**20**

Note: BSC: Basic Science Course, **ESC**: Engineering Science Course, **HSMC**: Humanity and Social Science & Management Courses, **AEC** –Ability Enhancement Courses.

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The activities can be can be spread over the years, anytime during the semester weekends and holidays, as per the liking and convenience of the student from the year of entry to the programme. However, the minimum hours' requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression.

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Visvesvaraya Technological University, Belagavi
Scheme of Teaching and Examinations 2021
Outcome-Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021 – 22)

I Semester (Chemistry Group) **[Common to all B.E./B.Tech. Programmes]**

Sl. No	Course and Course Code		Course Title	Teaching Department (TD)and Paper Setting Board(PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self-Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	BSC	21MAT11	**Calculus & Differential Equations**	TD and PSB: Mathematics	2	2	--		03	50	50	100	3
2	BSC	21CHE12	Engineering Chemistry	TD and PSB: Chemistry	2	2	--		03	50	50	100	3
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4	ESC	21ELN14	Basic Electronics & Communication Engineering	TD: ECE/E and I/ TC PSB: ECE	2	2	--		03	50	50	100	3
5	ESC	21EME15	Elements of Mechanical Engineering	TD: ME, Auto, IP,IEM, Mfg .Engineering PSB: Mechanical Engg	2	--	2		03	50	50	100	3
6	BSC	21CHEL16	Engineering Chemistry Laboratory	TD and PSB: Chemistry	--	--	2		03	50	50	100	1
7	ESC	21CPL17	Computer Programming Laboratory	TD and PSB: Computer Science and Engineering	--	--	2		03	50	50	100	1
8	HSMC	21EGH18	Communicative English	TD and PSB: Humanities	1	1	1		02	50	50	100	2
9	AEC	21IDT19/29	Innovation and Design Thinking	Any Engineering Department	1	--	--		01	50	50	100	1
		OR											
		21SFH19/29	Scientific Foundations of Health										
				TOTAL	**13**	**09**	**07**		**24**	**450**	**450**	**900**	**20**

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Visvesvaraya Technological University, Belagavi

Scheme of Teaching and Examinations 2021

Outcome-Based Education(OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2021 – 22)

II Semester (For students who attended 1st semester under Chemistry Group) **[Common to all B.E./B.Tech Programs]**

Sl. No	Course and Course Code		Course Title	Teaching Department(TD) and Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self-Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	BSC	21MAT21	Advanced Calculus and Numerical Methods	TD and PSB: Mathematics	2	2	--		03	50	50	100	3
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4	ESC	21CIV24	Elements of Civil Engineering and Mechanics	TD and PSB: Civil Engineering	3	--	--		03	50	50	100	3
5	ESC	21EVN25	Engineering Visualization	TD: ME, Auto, IP,IEM, Mfg. Engineering PSB: Mechanical Engg	2	--	2		03	50	50	100	3
6	BSC	21PHYL26	Engineering Physics Laboratory	TD and PSB: Physics	--	--	2		03	50	50	100	1
7	ESC	21ELEL27	Basic Electrical Engineering Laboratory	TD and PSB: E and E Engineering	--	--	2		03	50	50	100	1
8	HSMC	21EGH28	Professional Writing Skills in English	TD and PSB: Humanities	1	1	1		02	50	50	100	2
9	AEC	21SFH19/29	Scientific Foundations of Health	Any Department	1	--	--		01	50	50	100	1
		OR											
		21IDT19/29	Innovation and Design Thinking										
				TOTAL	**13**	**07**	**07**		**24**	**450**	**450**	**900**	**20**

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BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

Autonomous Institute under VTU, Belagavi | Approved by AICTE, New Delhi | Recognized by Govt. of Karnataka

BE/B.Tech. Scheme of Teaching and Examinations
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2022-23)

MECHANICAL ENGINEERING

Scheme of Teaching and Evaluation for B.E Programs
With effect from the academic year 2021-22
Total Credits for B.E.: 160
Credits Distribution as per NEP 2020

SEM	HS	BS	ES	PC	PE	AEC	OE	PW	INT	SE	UHV	TOTAL
1	2	7	10	-	-	1	-	-	-	-	-	20
2	2	7	10	-	-	1	-	-	-	-	-	20
3	1	3	-	12	-	2	-	-	-	-	-	18
4	1	3	-	12	-	3	-	-	2	-	1	22
5	1	-	-	11	3	2	3	-	-	-	-	20
6	3	-	-	8	3	1	3	2	2	-	-	22
7	-	-	-	7	3	-	3	8	-	-	-	21
8	-	-	-	3	-	-	-	-	13	1	-	17
TOTAL	**10**	**20**	**20**	**53**	**9**	**10**	**9**	**10**	**17**	**1**	**1**	**160**

SN	Category
1	HS: Humanities and Social Sciences including Management courses
2	BS: Basic Science courses
3	ES: Engineering Science courses
4	IPCC: Integrated Professional core courses
5	PC: Professional core courses
6	PE: Professional Elective courses relevant to chosen specialization/branch
7	OE: Open Elective subjects offered by other departments
8	AEC: Ability Enhancement Courses
9	PW: Project work
10	SE: Seminar
11	INT: Internship in industry
12	UHV: Universal Human Values

III Semester

Scheme of Teaching and Examination 2022-23

SL	Course category	Course Code	Course	BOS / Teaching Department	BOE / Paper Setting Board	Teaching Hours per Week			Credits	Duration of Exam	Marks		
						L	T	P			CIE	SEE	Total
1	BSC	21MAT31	Applied Engg. Mathematics-I	Mathematics	Mathematics	2	2	0	3	3	50	50	100
2	IPCC	21ME32	Production Technology-I	Department of ME	Department of ME	3	0	2	4	3	50	50	100
3	PCC	21ME33	Material Science & Metallurgy	Department of ME	Department of ME	2	2	0	3	3	50	50	100
4	PCC	21ME34	Mechanics of Materials	Department of ME	Department of ME	2	2	0	3	3	50	50	100
5	PCC	21MEL35	Material Testing Laboratory	Department of ME	Department of ME	0	0	2	1	3	50	50	100
6	PCC	21MEL36	Foundry & Forging Laboratory	Department of ME	Department of ME	0	0	2	1	3	50	50	100
7	HSMC	21KSK37/47	Samskrutika Kannada Balake Kannada	Humanities	Humanities	0	2	0	1	-	100	----	100
		OR											
		21CIP37/47	Constitution of India and Professional Ethics							2	50	50	
8	AEC	21AME381	Introduction to CAD	Department of ME	Department of ME	0 For AEC as lab course 0 For AEC as theory course	0 2	2 0	1	2	50	50	100
9	AEC	21DTI39	Design Thinking and social innovation	Department of ME	Department of ME	0	2	0	1	2	50	50	100
			Total						18		500/ 450	400/ 450	900
Course prescribed to lateral entry Diploma holders admitted to III semester B.E./B.Tech programs													
10	NCMC	21MATDIP31	Additional Mathematics - I	Mathematics	-	2	2	0	0	-	100	-	100

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L: T: P) can be considered as (3: 0: 2) or (2: 2: 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE

IV Semester

Scheme of Teaching and Examination 2022-23

SL	Course category	Course Code	Course	BOS / Teaching Department	BOE / Paper Setting Board	Teaching Hours per Week			Credits	Duration of Exam	Marks		
						L	T	P			CIE	SEE	Total
1	BSC	21MAT41	Applied Engg. Mathematics-II	Mathematics	Mathematics	2	2	0	3	3	50	50	100
2	IPCC	21ME42	Mechanical Measurements & Metrology	Department of ME	Department of ME	3	0	2	4	3	50	50	100
3	PCC	21ME43	Fluid Mechanics	Department of ME	Department of ME	2	2	0	3	3	50	50	100
4	PCC	21ME44	Engineering Thermodynamics	Department of ME	Department of ME	2	2	0	3	3	50	50	100
5	PCC	21MEL45	Computer Aided M/c Drawing	Department of ME	Department of ME	0	0	2	1	3	50	50	100
6	PCC	21MEL46	Fluids Mechanics Lab	Department of ME	Department of ME	0	0	2	1	3	50	50	100
7	HSMC	21KSK37/47	Samskrutika Kannada Balake Kannada	HSMC	HSMC	0	2	0	1	--	100	---	100
		OR											
		21CIP37/47	Constitution of India and Professional Ethics							2	50	50	
8	AEC	21SSA480	Soft skills and basic aptitude	Humanities	Humanities	1	2	0	2	2	50	50	100
9	AEC	21AXX48X	Ability Enhancement Course	Department of ME	Department of ME	0 For AEC as lab course 0 For AEC as theory course	0 2	2 0	1	2	50	50	100
10	UHV	21UHV490	Universal Human Values			1	0	0	1	2	50	50	100
11	INT	21INT491	Summer Internship - I	Evaluation By the appropriate authorities		Completed during the intervening period of II and III semesters. Lateral entry students have to attend the internship during the intervening period of III and IV semesters			2	----	100	--	100
	Total								22		600/650	5E+05	1100
Course prescribed to lateral entry Diploma holders admitted to III semester B.E./B.Tech programs													
12	NCMC	21MATDIP41	Additional Mathematics - I	Mathematics	-		2		0	-	100	-	100

ABILITY ENHANCEMENT COURSE		
1	21ABE481	Biology for Engineers
2	21AME482	Introduction to Computer Graphics

Semester: III

(COMMON TO ME & CIVIL)

Course Name: **INTEGRAL TRANSFORMS & NUMERICAL METHODS**

Course Code	**21MCM31**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Number of Pedagogy Hours	**40**	**Total Marks**	**100**

Pre-requisites:

- Basic formulae of differentiation, partial differentiation, Integration
- Differential equations
- Periodic function

Module – 1

Fourier Series
Introduction to infinite series, Periodic functions, Dirichlet's conditions. Fourier series of periodic functions with period 2π. Fourier series of even and odd functions. Fourier series of arbitrary period $2l$. Half range Fourier series. Practical harmonic analysis.
Self –Study: Convergence and Divergence of series.

08 Hours

Module - 2

Infinite Fourier Transforms
Infinite Fourier transforms, definition, Fourier Sine and Cosine transforms. Inverse Fourier transforms, Inverse Fourier Cosine and Sine transforms. Problems.
Self –Study: Leibnitz rule for differentiation under integral sign.

08 Hours

Module – 3

Numerical Solution of first-Order ODEs
Taylor's series method, Modified Euler's method, Runge-Kutta method of order four, Milne's Predictor and Corrector formula, Adam's – Bashforth formula (No derivations only formulae).
Self-Study: Solution of ODE using Picard's method

08 Hours

Module - 4

Numerical Solution of Simultaneous and Second-Order ODEs
Simultaneous differential equations: Picard's method, Runge-Kutta method. (No derivations only formulae).
Second-order differential equations: Runge-Kutta method and Milne's Predictor and Corrector method. (No derivations only formulae).
Self-Study: Solution of ODE by analytical method.

08 Hours

Module – 5

Z-Transforms and Calculus of Variations
Z-Transform's definition, Z-transforms of standard functions. Damping and shifting rules, Problems. Inverse Z-transforms and applications to solve difference equations.
Calculus of Variations
Variation of a function, functional, Euler's equation. Standard variational problems. Applications of Calculus of Variations, Geodesics, Hanging cable (chain) problem.
Self-Study: Initial and final value theorem.

08 Hours

COURSE OUTCOMES:
At the end of the course, the student will be able to:

CO1	Demonstrate the Fourier series to study the behavior of periodic functions and their applications in system communications, digital signal processing and field theory.
CO2	Use Fourier transforms to analyze problems involving continuous-time signals.
CO3	Solve first order ODE arising in engineering problems using single step numerical methods.
CO4	Solve second order ODE arising in engineering problems using single step numerical methods.
CO5	Apply Z- Transform techniques to solve difference equations, Determine the extremals of functional using calculus of variations to solve problems arising in dynamics of rigid bodies and vibrational analysis.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Higher Engineering Mathematics	B.S.Grewal	Khanna Publishers	43rd Ed.2015
2	Advanced Engineering Mathematics	E. Kreyszig	Jhon willy & Sons	10th Ed. (Reprint).2016
Reference Books				
1	Higher Engineering Mathematics	B.V.Ramana	Tata McGraw-Hill	11th Edition.2010
2	Calculus	George. B. Thomas	Pearsons edn.Inc	13th Edition.2014
3	A Text book of Engineering Mathematics	N.P. Bali and Manish Goyal	Laxmi Publications	Latest edition

Semester: III

Course Name: PRODUCTION TECHNOLOGY -I

Course Code	**21ME32**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:2**	**SEE Marks**	**50**
Credits	**04**	**Exam Hours**	**03**
Total Number of pedagogy hours	**40 (T) + 20 (P)**	**Total Marks**	**100**

Pre-requisites: Knowledge of Basic sciences and Techniques**.**

Module – 1

Introduction & basic materials used in foundry: Introduction: Definition, Classification of manufacturing processes. Metals cast in the foundry-classification, factors that determine the selection of a casting alloy. Introduction to casting process & steps involved

Patterns: Definition, classification, materials used for pattern, various pattern allowances and their importance.

Sand moulding: Types of base sand, requirement of base sand. Binder, Additive's definition, need and types; Moulding machines- Jolt type, squeeze type and Sand slinger.

Study of important moulding process: preparation of sand moulds. Green sand, core sand, dry sand, sweep mould, CO_2 mould, shell mould, investment mould, plaster mould, cement bonded mould.

Cores: Definition, need, types. Method of making cores,

Concept of gating (top, bottom, parting line, horn gate) and risers (open, blind) Functions and types. Pressurized and non-pressurized gating systems, gating ratio, simple volume calculations.

08 Hours

Module - 2

Melting furnaces: Classification of furnaces, Gas fired pit furnace, Resistance furnace, Coreless induction furnace, electric arc furnace, constructional features & working principle of cupola furnace.

Casting using metal moulds: Gravity die casting, pressure die casting, centrifugal casting, squeeze casting, slush casting, thixo-casting, and continuous casting processes. Casting defects, their causes and remedies.

08 Hours

Module – 3

METAL FORMING PROCESSES

Metal Forming Processes: Introduction, Hot and Cold working processes. Variables affecting metal forming processes. Fundamentals of metal working, Analysis of bulk forming processes like Forging: operations, processes, defects, expressions for forging pressure and loads. Simple numerical problems. Rolling, types of rolling mills, expressions and calculations in rolling load, torque, power etc. Extrusion: types of extrusion processes, extrusion of seamless tubes

Wire drawing, tube drawing, drawing equipment's and dies.

Other sheet metal processes: Sheet metal forming processes die and punch assembly, Blanking, piercing, bending, Compound and Progressive die. High Energy rate forming processes: Explosive forming, electro hydraulic forming, electro-magnetic forming.

08 Hours

Module – 4

JOINING PROCESSES

Operating principle, basic equipment, merits and applications of Fusion welding processes: Gas welding - Types – Flame characteristics; Manual metal arc welding – Gas Tungsten arc welding - Gas metal arc welding – Submerged arc welding, atomic hydrogen welding.

Advance welding processes: Resistance welding processes, friction stir welding (FSW), Thermit welding, Laser beam welding, electron beam welding, and explosive welding.

08 Hours

Module – 5

Weldability and thermal aspects: Concept of weldability of materials; Thermal Effects in Welding, structure of welds, Distortion, shrinkage and residual stresses in welded structures heat affected zone; Welding defects and remedies.

Principles of Soldering, Brazing and adhesive bonding. Inspection methods: methods used for casting and welding, magnetic particle inspection, ultrasonic, radiography, eddy current, holography.

08 Hours

PRACTICAL COMPONENT OF IPCC

Sl. No.	Experiments
1	Introduction to Arc welding tools and welding equipment, Preparation of welded joints using Arc Welding equipment L-Joint, T-Joint, Butt joint, V-Joint, Lap joints on M.S. flats
2	Soldering/Brazing/
3	Introduction to Molding sand and Core sand
4	Introduction to **foundry** tools and other equipment's.
5	Introduction to **forging** tools and other equipment's.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Select appropriate primary manufacturing process and related parameters for obtaining initial shape and size of components.
CO2	Design and develop adequate tooling linked with casting, welding and forming operations.
CO3	Appreciate the effect of process parameters on quality of manufactured components.
CO4	Demonstrate various skills in preparation of moulding sand for conducting tensile, shear and compression tests using Universal sand testing machine.
CO5	Demonstrate skills in preparation of forging models involving upsetting, drawing and bending operations and Demonstrate skills in preparation of Welding models.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Principles of foundry technology,	P L Jain,	4th edition, Tata McGraw Hill,	2006.
2	‘Welding and Welding Technology’	Little R. L.	Tata McGraw Hill Publishing Company Limited, New Delhi	1989
3	Principles of Metal Casting	Richard w. heine, carl Rloper, Philip C. Rosenthal	Tata McGraw Hill education pvt. Limited Company,	1976
4	Mechanical Metallurgy	G.E. Dieter	Tata McGraw Hill Publishing Company Limited,	2001
5	Production Technology	O.P. Kanna &Lal.	Dhanpat Rai publications	2012
Reference Books				
1	Manufacturing process-1	Dr. Radhakrishna	Sapna book house, 5th revised edition	2009
2	Process and materials of manufacturing	Roy A Lindberg	Pearson Edu, 4th edition	2006
3	Manufacturing Technology-Foundry, Forming and Welding,	P. N. Rao.	Tata McGraw Hill, 3rd Ed.,	2003
4	Welding technology	O.P. Khanna	Dhanpat Rai publications	1980
5	Elements of Workshop Technology (Vol.1andVol.2)	Hazra Choudhry and Nirzar Roy	Media Promoters and Publishers Pvt. Ltd.	2010

Semester: III

Course Name: MATERIAL SCIENCE AND METALLURGY

Course Code	**21ME33**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Number of Pedagogy Hours	**40**	**Total Marks**	**100**

Pre-requisites: Knowledge of Basic mathematics and sciences.

Module – 1

Mechanical Behaviour: Stress- Strain diagram showing ductile and brittle behaviour of materials, Linear and non-linear elastic behaviour and properties, mechanical Properties in plastic range, Concept of offset yield strength and ductility,
Solids: crystalline solids and non-crystalline solids, deformation of single crystal by slip and twinning. Atomic diffusion, flick's laws of Diffusion, Factors attaching the Diffusion, Fracture and its types.
Creep: High temperature and high pressure. Description of the phenomenon with examples, 3 stages of creep properties, stress relaxation Concept.
Fatigue: types of fatigue loading with examples, Mechanism of fatigue, Fatigue properties, Fatigue testing and S-N diagram.

08 Hours

Module - 2

Solidification and phase diagram: Mechanism of solidification, Homogenous and Heterogeneous nucleation. Crystal Growth, cast metal structures, Phase diagram.
Solid solutions: Substitution and Interstitial solid solution, Hume rothary rule, Intermediate phase, construction of equilibrium diagram involving complete and partial solubility, lever rule, Gibb's phase rule, critical radius of nucleation, Iron-carbon system, Fe-Fe3C diagram, invariant reactions, different phases. Introduction to alloy steels – HSS and SS. Effect of alloying elements. Mechanism of strengthening in metals.

08 Hours

Module - 3

Heat Treating of metals: Definition and Importance of Heat Treatment, Annealing and its types, Normalizing, Hardening, Tempering, Martempering, Austempering, hardenability, TTT curves, Continuous Cooling Transformation curves.
Surface hardening methods: Carburizing, Cyaniding Nitriding, flame hardening and induction hardening, age hardening of aluminum and copper alloys. Ferrous and non-ferrous materials: Properties composition and use of grey cast iron, malleable iron, SG iron and steel. Copper alloys-brasses and bronzes, aluminum alloys Al-Cu, Al-Si, Al-Zn alloys.

08 Hours

Module – 4

Polymers and Ceramics: Types, Structure, Properties and applications
Composite materials: Definition, classification, type of matrix materials and reinforcements, advantages and application of composites.

Processing of Composites: Layup and curing, fabricating process, open and closed mould process, hand layup technique; structural laminate bag molding, production procedures for bag molding; filament winding, pultrusion, pulforming, thermo-forming, injection molding, blow molding.
Metal Matrix Composites (MMC's): Reinforcement materials, types, characteristics and selection, base metals selection. Need for MMC's and its application.
Carbon fiber composites: definition classification and applications

08 Hours

Module – 5

Smart Materials: Piezoelectric Materials, Electro-strictive Materials, Magneto-strictive Materials, Magneto-electric Materials. Magneto-rheological Fluids, Electro-rheological Fluids, Shape Memory Materials, Fiber-Optic Sensors. Nano materials and their applications. Characterization of powders: (Particle Size & Shape Distribution), Powder Shaping: Particle Packing Modifications, Lubricants & Binders, Powder Compaction & Process, Sintering and Application of Powder Metallurgy
Microscopy: Introduction to construction and working principle, the necessity of characterization using SEM and TEM techniques, Diffraction: Fundamentals of Diffraction, Bragg's law, X-ray diffraction pattern of crystalline and amorphous material.

08 Hours

COURSE OUTCOMES:
At the end of the course, the student will be able to:

CO1	Examine the micro structure, defects, diffusion and mechanical properties of various materials.
CO2	Analyze various phases of metals and alloys through phase diagrams, effect of alloying elements, properties and application of ferrous and non-ferrous metals.
CO3	Recommend appropriate heat treatment processes for suitable applications
CO4	Suggest suitable engineering materials for different applications
CO5	Apply characterization techniques for structure and property analysis using SEM.

Suggested Learning Resources:

Text Books

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Materials Science and Engineering	Callister Jr, W.D., Rethwisch, D.G.,	Hoboken, NJ: Wiley	10th Ed., 2018
2	Materials Selection in Mechanical Design	Ashby, M. F	Butterworth-Heinemann.	4th Ed., 2010
3	Introduction to Physical Metallurgy	Avner, S.H	McGraw Hill Education	2nd Ed., 2017

Reference Books

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Engineering Materials 1: An Introduction to	Jones, D.R.H., and Ashby,M.F	Butterworth-Heinemann	4th Ed., 2011

	Properties, Application and Design			
2	Engineering Materials 2: An Introduction to Microstructure and Processing	Jones, D.R.H., and Ashby,M.F	Butterworth-Heinemann	4th Ed., 2012
3	Physical Metallurgy Principles	Abbaschian, R., Abbaschian, L., Reed-Hill, R. E	Cengate Learning	4th Ed., 2009

Semester: III

Course Name: MECHANICS OF MATERIALS

Course Code	**21ME34**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Number of Pedagogy Hours	**40**	**Total Marks**	**100**

Pre-requisites: Engineering Mechanics

Module – 1

Stresses and Strains: Introduction, Properties of materials, Stress, Strain and Hooke's law, Stress strain diagram for brittle and ductile materials, True stress and strain, Calculation of stresses in straight, Stepped and tapered sections. Principle of super position.
Composite sections: Stresses due to temperature change, Shear stress and strain, Lateral strain and Poisson's ratio, Elastic constants and relations between them.

08 Hours

Module - 2

Analysis of Stress and Strain: Introduction to three-dimensional state of stress, Stresses on inclined planes, Principal stresses and maximum shear stress, Principal angles, Shear stresses on principal planes, Maximum shear stress, Mohr circle for plane stress conditions.
Thick & Thin Cylinders: Hoop's stress, maximum shear stress, circumferential and longitudinal strains. Lames equations.

08 Hours

Module – 3

Shear Force and Bending Moment: Type of beams, Loads and reactions, Relationship between loads, shear forces and bending moments, Shear force and bending moments of cantilever beams, Pin support and roller supported beams subjected to concentrated loads, uniformly distributed constant / varying loads. Concept of shear center.
Stresses in Beams: Bending and shear stress distribution in rectangular, I and T section beams.

08 Hours

Module – 4

Deflection of Beams: Introduction, differential equation for deflection, equations for deflections, slope and moments, Methods: Double integration method for cantilever and simply supported beams for point loads, UDL and couple, Macaulay's method.
Torsion: Introduction, pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity/stiffness of shafts, power transmitted by solid and hollow circular shafts.

08 Hours

Module – 5

Columns: Buckling and stability, Critical load, Columns with pinned ends, Columns with other support conditions, Effective length of columns, Rankine's and Secant formula for columns.
Introduction to Strain Energy: Strain energy due to axial, shear, bending, torsion and impact load. Castigliano's theorem I and II and their applications.

08 Hours

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Interpret simple, compound, thermal stresses and strains their relations and strain energy.
CO2	Analyze structural members for stresses, strains and deformations.
CO3	Examine the structural members subjected to bending and shear loads.
CO4	Investigate shafts subjected to twisting loads.
CO5	Analyze the short columns for stability.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Mechanics & Strength of Materials	K Raghavendra, 1st edition	CBS Publishers & Distributors Pvt. Ltd., Delhi	2019
2	Mechanics of Materials	J M Gere, B J Goodno, 8th edition	Cengage Learning	2013
3	Mechanics of Materials	Ferdinand Beer, Russell Johston, John Dewolf, David Mazurek	McGraw Hill Education (India) Pvt. Ltd	Latest edition
4	Strength of Materials	S. S. Rattan 2nd edition	Tata McGraw Hill	2008
5	Strength of Materials	R K Rajput	S. Chand and Company Pvt. Ltd	2014
6	Strength of Materials	R. Subramanian	Oxford press	2005
Reference Books				
1	Strength of Materials	S. S. Bhavikatti, 4th edition	Vikas Publishing House-Pvt. Ltd.,	2013
2	A Text book of Strength of Materials	R. K. Bansal	Laxmi Publications	2010
3	Strength of Materials	W. A. Nash, 4th edition	Schaum's Outline Series,	2007
4	Mechanics of Materials	R C Hibbeler	Pearson	Latest edition

Semester: III

Course Name: MATERIAL TESTING LABORATORY

Course Code	**21MEL35**	**CIE Marks**	**50**
Teaching Hour / Week (L:T:P)	**0:0:2**	**SEE Marks**	**50**
Credits	**01**	**Exam Hours**	**03**
Total Number of Pedagogy Hours	**20**	**Total Marks**	**100**

Pre-requisites: Knowledge of Basic mathematics and sciences.

Part-A

1. Specimen preparation for macro and micro structural examinations and study the macrostructure and microstructure of a given Cast Iron, Mild steel, Aluminium and Copper/Brass specimens sample metal/ alloys
2. To determine the hardness values of Mild Steel/ Aluminium, Copper/Brass and Cast Iron by Rockwell hardness testing machine.
3. To determine the hardness values of Mild Steel/ Aluminium, Copper/Brass and Cast Iron by Brinell's Hardness testing machine.
4. To determine the hardness values of Mild Steel/ Aluminium, Copper/Brass and Cast Iron by Vickers Hardness testing machine.
5. To conduct a wear test on Mild steel/ Cast Iron/Aluminium/ Copper to find the volumetric wear rate and coefficient of friction
6. Study the heat treatment processes (Hardening and tempering) of steel/Aluminium specimens
7. To perform the non-destructive testing's **(Open-Ended Experiment)**
   a) Dye Penetration
   b) Magnetic particle detection

Part-B

1. To determine the impact strength of Cast Iron, Mild Steel/Brass/ Aluminium and to observe the necking using Charpy impact test.
2. To determine the tensile strength, modulus of elasticity, yield stress, % of elongation and % of reduction in area of Cast Iron, Mild Steel/Brass/ Aluminium and to observe the necking.
3. To determine the compressive strength, of Cast Iron, Mild Steel/Wood/ Aluminium and to observe the necking.
4. To determine the bending strength, of Cast Iron/Mild Steel/Brass/ Aluminium and to observe the necking.
5. To determine the shear strength, of Cast Iron, Mild Steel/Brass/ Aluminium and to observe the necking.
6. To determine the torsional strength, of Cast Iron, Mild Steel/Brass/ Aluminium and to observe the necking.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Identify the structure of materials - crystallography, microstructure, defects, and diffusion.
CO2	Analyze various phases of metals and alloys with phase diagrams.
CO3	Select suitable heat treatment process based on material properties
CO4	Suggest suitable engineering materials for different application
CO5	Apply characterization techniques for structure and property analysis using SEM.

Semester: III

Course Name: FOUNDRY AND FORGING LAB

Course Code	**21MEL36**	**CIE Marks**	**40**
Teaching Hours/Week (L:T:P)	**0:0:2**	**SEE Marks**	**60**
Credits	**01**	**Exam Hours**	**03**
Total Number of Pedagogy Hours	**20**	**Total Marks**	**100**

Pre-requisites: Knowledge of Basics sciences and Techniques**.**

Experiments

PART A

I. Testing of Molding sand and Core sand.

Preparation of sand specimens and conduction of the following tests:
1. Compression, Shear and Tensile tests on Universal Sand Testing Machine.
2. Permeability test
3. Sieve Analysis to find Grain Fineness Number (GFN) of Base Sand
4. Clay content determination on Base Sand.

PART B

II. Foundry Practice:

Use of foundry tools and other equipment for Preparation of molding sand mixture.
1. Preparation of green sand molds kept ready for pouring in the following cases:
2. Using two molding boxes (hand cut molds).
3. Using patterns (Single piece pattern Split pattern and match plate pattern).
4. Incorporating core in the mold. (Core boxes).
5. Preparation of one casting (Aluminum or cast iron-**Open-Ended Experiments)**

III. Forging Operations: Use of forging tools and other forging equipment.
1. Calculation of length of the raw material required to prepare the model considering forging losses.
2. Preparing minimum three forged models involving upsetting, drawing, bending and other forging operations.
3. Preparation of simple forging model using power hammer **(Open-Ended Experiments)**

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Carry out experimental procedures to evaluate different properties of sand samples.
CO2	Identify various foundry and forging tools & equipments.
CO3	Prepare different types of sand mould using foundry tools and operations.
CO4	Design sand moulds as per the given drawing.
CO5	Prepare forging models using appropriate tools and equipment.

Semester: III / IV

Course Name: CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND CYBER LAW

Course Code	**21CIP37/47**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**1-0-0**	**SEE Marks**	**50**
Credits	**01**	**Exam Hours**	**02**
Total Hours of Pedagogy	**15**	**Total Marks**	**100**

Module – 1

Introduction to Indian Constitution
The Making of the Constitution, The Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India. Fundamental Rights. Directive Principles of State Policy (DPSP). Fundamental Duties.

03 Hours

Module - 2

Union Executive and State Executive:
Parliamentary System, Federal System, Union Executive – President, Prime Minister, Union Cabinet, Parliament – Union Legislature, Lok Sabha and Rajya Sabha types of bills. Union judiciary Supreme Court of India.

03 Hours

Module – 3

Elections, Amendments and Emergency Provisions Elections, Electoral Process, and Election Commission of India, Election Laws. Amendments - Methods in Constitutional Amendments. Important Constitutional Amendments. Amendments – 7,9,10,12,42,44, 61, 73,74, ,75, 86, and 91,94,95,100,101,118. Emergency Provisions, types of Emergencies and its consequences. Special Provisions (Articles 370.371,371J) for some States

03 Hours

Module – 4

Professional / Engineering Ethics: Scope & Aims of Engineering & Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Role morality. What is profession characteristic of profession? The NSPE board of Professional ethics. Engineering ethics as preventive ethics. Responsible Engineer. Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. What is conflict of interest? Honesty integrity and reliability. IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering.

03 Hours

Module – 5

Internet Laws, Cyber Crimes and Cyber Laws: Internet and Need for Cyber Laws, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000. Cybercrimes and enforcement agencies.

03 Hours

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Demonstrate constitutional knowledge and legal literacy.
CO2	Understand Engineering and Professional ethics and responsibilities of Engineers
CO3	Understand the cybercrimes and cyber laws for cyber safety measures

Suggested Learning Resources:

Text Books				
Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Constitution of India, Professional Ethics and Human Rights Shubham Singles	Charles E. Haries, and et al	Cengage Learning India	2018
2	Introduction to the Constitution of India	Durga Das Basu	Prentice –Hall	2008
3	Engineering Ethics	M. Govindarajan, S. Natarajan, V. S. Senthilkumar	Prentice –Hall	2004

Reference Books				
Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Cyber Security and Cyber Laws	Alfred Basta and et al	Cengage Learning India	2018

Semester: III

Name of the Laboratory: INTRODUCTION TO CAD

Course Code	**21AME381**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**0:0:2**	**SEE Marks**	**50**
Credits	**01**	**Exam Hours**	**02**
Total Number of pedagogy hours	**15**	**Total Marks**	**100**

Pre-requisites: Knowledge of Basic mathematics and Engineering Drawing.

PART-A

Introduction to Auto CAD: File management, User interface, Basic settings, Navigation bar, Steering wheel, View port

Draw Setting & Condition: Units, Limits, UCS icon Function keys & its work

Drawing Tools: Line, polyline, Circle, arc Rectangle, polygon Ellipse, Elliptical arc, spline, Spline Edit, Xline, Ray, Points Measure, Divide, Region Wipeout, Helix, Donut, Revision cloud, hatch, Gradient

Modify Tools: Move, copy, Rotate, scale Stretch, fillet, chamfer Erase, offset, explode Array, polar Array, path array Trim, extend, mirror, edit polyline, edit spline, edit hatch Edit array, break, break at point Blend vertex, joint, overkill, lengthen

Annotations Dimensions: dimension setting, Linear dimension, Aligned dimension, Angular dimensions, arc length, Radius Diameter.

PART-B

Conversion of pictorial views into orthographic projections of simple machine parts.
Conversion of orthographic views in to isometric view of simple machine parts. **(Open-Ended Experiments)**

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Apply basic CAD concepts to develop and construct accurate 2D geometry through creation of basic geometric constructions
CO2	To improve their visualization skills and make component sketching.
CO3	Apply elements of mechanical drafting such as layers, dimensions, drawing formats in projects with a focus on ANSI industry standards.
CO4	Utilize the precision of Auto CAD as a drafting and design tool used in the mechanical design and manufacturing industries.
CO5	Engage in lifelong learning using sketching and drawing as communication tool.

Semester: III

Course Name: **DESIGN THINKING & INNOVATION**

Course Code	21DTI39	CIE Marks	50
Teaching Hours/Week (L:T:P)	1:0:0	SEE Marks	50
Credits	1	Exam Hours	02
Total Hours of Pedagogy	15	Total Marks	100

Course Category: Foundation

Preamble: This course provides an introduction to the basic concepts and techniques of engineering and reverses engineering, the process of design, analytical thinking and ideas, basics and development of engineering drawing, application of engineering drawing with computer aide.

Module – 1

PROCESS OF DESIGN

Understanding Design thinking: Shared model in team-based design – Theory and practice in Design thinking – Explore presentation Signers across globe – MVP or Prototyping

5-Hours

Module - 2

Tools for Design Thinking

Real-Time design interaction captures and analysis – Enabling efficient collaboration in digital space – Empathy for design – Collaboration in distributed Design

5-Hours

Module – 3

Design Thinking in IT

Design Thinking to Business Process modelling – Agile in Virtual collaboration environment – Scenario based Prototyping

5-Hours

Module – 4

DT For strategic innovations

Growth – Story telling representation – Strategic Foresight - Change – Sense Making - Maintenance Relevance – Value redefinition - Extreme Competition – experience design - Standardization – Humanization - Creative Culture – Rapid prototyping, Strategy and Organization – Business Model

5-Hours

Module – 5

Design thinking workshop

Design Thinking Workshop Empathize, Design, Ideate, Prototype and Test

5-Hours

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Understand the design thinking process.
CO2	Identify and assess opportunities through customer needs analysis.
CO3	Create clear product specifications based on customer needs that are desirable, feasible, and viable.
CO4	Generate and evaluate new product and service concepts through applied creativity.
CO5	Implement a proven 4-step method for planning and executing a prototype.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Engineering Design	John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson	Cengagelearning	Second Edition, 2013
2	The Design of Business	Roger Martin	Harvard Business Press	2009
3	Design Thinking: Understand – Improve– Apply	Hasso Plattner, Christoph Meinel and Larry Leifer	Springer	2011.
Reference Books				
1	Design Thinking for Strategic Innovation	Idris Mootee	John Wiley & Sons	Second Edition, 2011.
2	Engineering Design Process	Yousef Haik and Tamer M.Shahin	CengageLearning	1st edition, 2012

Semester: III

Course Name: **Additional Mathematics-I**

Course Code	**21MATDIP31**	**CIE Marks**	**100**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**--**
Credits	**00**	**Exam Hours**	**00**

Pre-requisites: Algebraic formulae, Differentiation, Integration, Trigonometric formulae

Module – 1

Linear Algebra
Introduction-Rank of matrix by elementary row operations- Echelon form. Consistency of system of linear equations, Solution of linear equations-Gauss elimination method. Eigen values and Eigen vectors of a square matrix. Problems.
Self-Study: Gauss Jordon Method

08 Hours

Module - 2

Differential Calculus:
Review of successive differentiation-Illustrative examples. Maclaurin's series expansions-Illustrative examples. Partial Differentiation: Euler's theorem-problems on first order derivatives only. Total derivatives-differentiation of composite functions. Jacobian of order two-problems.
Self-Study: Taylor's series expansion**.**

08 Hours

Module – 3

Vector Differentiation:
Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and Vector point functions. Gradient, Divergence and Curl- Simple problems. Solenoidal and irrotational vector fields-Problems.
Self-Study: Angle between two surfaces

08 Hours

Module – 4

Integral Calculus:
Review of elementary integral calculus. Reduction formulae for $Sin^n x, Cos^n x$(with proof) and $Sin^m x\ Cos^n x$ (without proof) and evaluation of these with standard limits-Examples. Double and triple integrals-Simple problems.
Self-Study: Change of Order of Integration.

08 Hours

Module – 5

Ordinary Differential Equations:
Introduction-Solutions of first order and first-degree differential equation: exact, Equation reducible to exact. Linear differential equations and Bernoulli's equation.
Self-Study: Homogeneous differential equations

08 Hours

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Make use of matrix theory for solving system of linear equations and compute eigen values and eigen vectors.
CO2	Learn the notion of partial differentiation to calculate the rate of change of multivariate functions and solve problems related to composite functions and Jacobians.
CO3	Illustrate the applications of multivariate calculus to understand the solenoidal and irrotational vectors.
CO4	Apply the concept of integration and variables to evaluate multiple integrals and their usage in computing the area and the volumes.
CO5	Solve first order linear differential equations analytically using standard methods.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Higher Engineering Mathematics	B.S.Grewal	Khanna Publishers	43rd Ed.2015
2	Advanced Engineering Mathematics	E. Kreyszig	Jhon willy & Sons	10th Ed. (Reprint).2016
3	Additional Mathematics-1	Dr. Pandurangappa	Sanguine Technical Publishers	4Th Ed., 2019.
Reference Books				
1	Higher Engineering Mathematics	B.V.Ramana	Tata McGraw-Hill	11th Edition.2010

Semester: IV
(COMMON TO CIVIL & ME)

Course Name: COMPLEX ANALYSIS, PROBABILITY & STATISTICAL METHODS

Course Code	21MCM41	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Credits	03	Exam Hours	03
Number of Pedagogy Hours	40	Total Marks	100

Pre-requisites:

- Basic formulae of differentiation, partial differentiation, Integration.
- Complex numbers.
- Statistics and probability.

Module – 1

Complex Analysis
Review of a function of a complex variable, limits, continuity and differentiability. Analytic function, Cauchy-Riemann equations in Cartesian and polar forms and consequences. Construction of analytic functions by Milne-Thompson method, problems. Conformal Transformation-Introduction, Bilinear transformation.
Complex Integration
Line integral of a complex function, Cauchy's theorem and Cauchy's integral formula and problems.
Self-Study: Conformal Transformation: Discussion of transformations:
$w = e^z$, $w = z^2$, $w = z + 1/z \ (z \neq 0)$.

08 Hours

Module - 2

Optimization: Basic concepts, classification of optimization problems. Linear programming problem (LPP). Formation of LPP. Graphical method and Simplex method to solve linear LPP.
Self-Study: Duality Theory.

08 Hours

Module – 3

Statistical Methods: Correlation and regression, Karl Pearson's coefficient of correlation and rank correlation, problems. Regression analysis, lines of regression, problems.
Curve Fitting: Curve fitting by the method of least squares, fitting the curves of the forms
$y = ax + b$, $y = ax^b$ and $y = ax^2 + bx + c$.
Self-Study: Angle between two regression lines, problems.

08 Hours

Module – 4

Probability Distributions: Random Variables (discrete and continuous), probability mass and density functions, problems. Binomial, Poisson and normal distributions, problems (derivations for mean and standard deviation for Binomial and Poisson distributions only)-Illustrative examples.
Self-Study: Exponential distribution.

08 Hours

Module – 5

Joint Probability Distributions: Joint Probability distribution for two discrete random variables, expectation, covariance and correlation.
Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, Student's t-distribution and Chi-square distribution as a test of goodness of fit.
Self-Study: Point estimation and interval estimation.

08 Hours

COURSE OUTCOMES:
At the end of the course, the student will be able to:

CO1	Explain the idea of analyticity, potential fields, residues and poles of complex potentials in Field Theory and Electromagnetic theory.
CO2	Apply the graphical and simplex method to solve the LPP.
CO3	Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
CO4	Applying discrete and continuous probability distributions in analysing the probability models arising in engineering field.
CO5	Construct joint probability distributions and demonstrate the validity of testing hypothesis.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Higher Engineering Mathematics	B.S.Grewal	Khanna Publishers	43rd Ed.2015
2	Advanced Engineering Mathematics	E. Kreyszig	Jhon willy & Sons	10th Ed. (Reprint).2016
3	Operations Research	S.D.Sharma	Kedarnath & Ramanath	17 th edition
Reference Books				
1	Higher Engineering Mathematics	B.V.Ramana	Tata McGraw-Hill	11th Edition.2010
2	Calculus	George. B. Thomas	Pearsons edn.Inc	13th Edition.2014
3	A Text book of Engineering Mathematics	N.P. Bali and Manish Goyal	Laxmi Publications	Latest edition

Semester: IV

Course Name: Mechanical Measurements and Metrology

Course Code	**21ME42**	**CIE Marks**	**50**
Teaching Hour / Week (L:T:P)	**3:0:2**	**SEE Marks**	**50**
Credits	**04**	**Exam Hours**	**03**
Total Number of Pedagogy Hours	**40 (T) + 20 (P)**	**Total Marks**	**100**

Pre-requisites: Knowledge of Basic mathematics and sciences.

Module – 1

Introduction to Metrology,

Introduction to metrology & measurements, definition, objectives and classification of metrology, standards of length- material standards, wave length standard, sub division of standards. Line and end standard, end bars, numerical problems on calibration of end bars.

Linear and Angular Measurements

Vernier Calipers and Micrometer, slip gauges, wringing phenomena, and numerical problems on building of slip gauges. Angular Measurements Bevel protractor, sine bar, angle gauges, numerical on building of angles, autocollimator, measurement of straightness, squareness.

8 Hours

Module - 2

Systems of Limits, Fits, Tolerance & Gauging

Definitions Tolerance, tolerance analysis (Addition & Subtraction of tolerances), principle of interchangeability and selective assembly. Class and Grade of tolerance, limits & fits -Applications, types of fits Numerical on limits, fits & tolerance. Hole basis and Shaft basis system, Classification of gauges, Taylor's principle, design of GO, NO GO gauges, wear allowance on gauges, types of gauges- plain plug gauges, ring gauges, snap gauge, limit gauge, simple problems

Comparators

Introduction to comparators, classification, characteristics, Mechanical comparators – Dial Indicator, Johnson Mikrokator, Sigma comparator, Electrical Comparator - LVDT, Optical Comparator - Zeiss ultra-optimeter, Pneumatic comparator – Principle of back pressure, Solex comparator.

8 Hours

Module – 3

Screw thread Measurement

Screw thread terminology, Measurements of major, minor and effective diameters by 2 wire, 3 wire & best size wire methods. Measurement of pitch and angle of screw threads, Tool maker's microscope, profile projector.

Gear tooth measurement

Tooth thickness measurement using constant chord method, addendum, and base tangent method, pitch measurement, concentricity and run out, involute profile and Gear roll tester for composite error.

8 Hours

Module – 4

Measurement System and Basic Concepts

Definitions - accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system-response-time delay, errors in measurement, Generalized measurement system.

Transducers Intermediate & Terminating Devices

Primary & secondary transducers, Electrical transducers, Mechanical, Electronic transducers, relative comparison. Mechanical systems - Inherent problems, Electrical Intermediate Modifying devices – Current, Voltage circuits, Amplifiers, terminating devices - CRO, Oscillographs, XY Plotter

8 Hours

Module – 5

Measurement of Force, Torque & Pressure

Measurement of Force (Analytical Balance, Proving ring, Load cell) Torque & Pressure, types of dynamometers – Prony brake, Rope brake dynamometers, Pirani gauge, Mc leod gauge, Bridgeman gauge.

Temperature & Strain Measurements

Theory of Strain gauges, gauge factor, electrical resistance type, Preparation and Mounting of strain gauges, Methods of strain measurement. Temperature compensation, resistance thermometers, thermo couple, laws of thermo couple, Pyrometer, Optical Pyrometer.

8 Hours

Practical Component of IPCC

List of Experiments

1. Calibration of Pressure Gauge
2. Calibration of Thermocouple
3. Calibration of LVDT
4. Calibration of Load cell
5. Determination of modulus of elasticity of a mild steel specimen using strain gauge.
6. Measurements using Toolmakers Microscope, Optical Projector
7. Measurement of angle using – Sine Bar, Sine Center, Bevel Protractor methods
8. Measurement of alignment using autocollimator
9. Measurement of cutting tool forces using Lathe Tool Dynamometer, Drill Tool Dynamometer **(Open-Ended Experiment)**
10. Measurement of Screw thread Parameters using 2 wire and 3 wire method
11. Measurement of Gear tooth Profile using Gear tooth Vernier **(Open-Ended Experiment)**
12. Calibration of Micrometer using Slip Gauges
13. Measurement using Optical Flats

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Comprehend the objectives of metrology, methods of measurement, and standards of measurement & apply concepts of linear and angular measurements.
CO2	Apply concepts of tolerance, limits of size, fits, geometric and position tolerances, gauges and their design
CO3	Illustrate the working principle of different comparators and assess various parameters of screw threads and gear.
CO4	Analyze and Differentiate measurement systems - transducers, intermediate modifying devices and terminating devices.
CO5	Evaluate the functioning of force, torque, pressure, strain and temperature measuring devices.

Suggested Learning Resources:

Text Books				
Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Engineering Metrology	R.K. Jain	Khanna Publishers	2009
2	Engineering Metrology and Measurements	Bentley	Pearson Education	
3	Engineering Metrology	Gupta I.C	Dhanpat Rai Publications	
4	Engineering Metrology and Measurements	N.V. Raghavendra and L.Krishnamurthy	Oxford University Press.	
5	Metrology	Mahajan	Danpath Rai publications	
6	Mechanical Measurements	Beckwith Marangoni andLienhard	Pearson Education	6th Ed., 2006
7	Instrumentation, Measurement and Analysis	B C Nakra, K KChaudhry	McGraw–Hill	4th Edition

Reference Books				
Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Industrial Instrumentation	Alsutko, Jerry. D.Faulk, Thompson	Asia Pvt. Ltd.	2002
2	Measurement Systems	Ernest O. Doebelin & Dhanish N. Manik	6th editions, Mc GRAW Hill Book Co.	2011
3	Mechanical Measurements and Instrumentation	Er. R K Rajput	S K Kataria & Sons Publications	2012

Semester: IV

COURSE NAME: FLUID MECHANICS

Course Code	**21ME43**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Number of Pedagogy Hours	**40**	**Total Marks**	**100**

Pre-requisites:

1. Vector Calculus
2. Engineering Mechanics

Module – 1

PROPERTIES OF FLUIDS: Introduction, properties of fluids, Density, Specific gravity, Vapour pressure, Viscosity, Surface Tension; compressibility, bulk modulus, Cavitation, Capillarity, classification of fluids, numericals.

Pressure Measurement: Pascal's law, hydrostatic Law, absolute, gauge, atmospheric and vacuum pressures, manometer (simple and differential), numericals.

08 Hours

Module - 2

Fluid Statics and Buoyancy Concepts of center of pressure along a horizontal plane, vertical plane and inclined plane surface submerged in static fluid, numericals.

Buoyancy, center of buoyancy, meta center and meta centric height (analytical method), numericals.

Fluid Kinematics: Velocity of fluid particle, types of fluid flow, description of flow, continuity equation, Coordinate free form, acceleration of fluid particle, rotational & irrotational flow, Laplace's equation in velocity potential and Poisson's equation in stream function, flow net. numericals.

08 Hours

Module - 3

Fluid Dynamics; Introduction. Forces acting on fluid in motion. Euler's equation of motion along a streamline. Integration of Euler's equation to obtain Bernoulli's equation, Application of Bernoulli's theorem such as venturi-meter, orifice meter, rectangular and triangular notches, numericals.

Impact of jets: Force exerted on stationary and moving plates- vertical, inclined and curved (symmetrical), numericals

08 Hours

Module – 4

FLOW THROUGH PIPES: Frictional loss in pipe flow, major energy losses and minor energy losses in pipe flow, Darcy- equation for loss of head due to friction in pipes, Chezy's equation for loss of head due to friction in pipes, hydraulic gradient and total energy line. numericals

Introduction to Boundary Layer Theory: Flow over a flat plate: Boundary layer thickness, Displacement, Momentum and Energy thickness, Flow separation concept, drag and lift force and numericals

08 Hours

Module – 5

Dimensional analysis: Introduction, derived quantities, dimensions of physical quantities, dimensional homogeneity, Rayleigh's method, Buckingham Pi-theorem, dimensionless numbers, similitude, types of similitude, numericals.

Compressible Flows: Introduction, thermodynamic relations of perfect gases, internal energy and enthalpy, speed of sound, pressure field due to a moving source, basic Equations for one-dimensional flow, stagnation and sonic properties, normal and oblique shocks, numericals.

08 Hours

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Describe various properties of fluids for analyzing fluid flow applications.
CO2	Apply the concepts of fluid mechanics, pressure distribution and buoyancy to determine the static forces of the fluids.
CO3	Analyze various Pipe losses.
CO4	Analyze external & internal flows for evaluating various flow-parameters.
CO5	Perform dimensional analysis to formulate mathematic model.

Suggested Learning Resources:

Text Books

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	A text book of Fluid Mechanics and Hydraulic Machines	Dr. R K Bansal	Laxmi Publications (P) Ltd,	
2	Fluid Mechanics, Hydraulics and Fluid Machines	Ramamrutham,	Dhanpat Rai Publications.	
3	Introduction to Fluid Mechanics	Fox and MacDonald	Wiley India.	8th Edition
4	Fundamentals of Fluid Mechanics	Munson, Young, Okiishi, Huebsch	Wiley publications	6th Edition,
5	Fluid Mechanics-Fundamentals & Applications	Yunus A Cengel and John A Cimbala	Tata McGraw Hill.	3rd Edition

Semester: IV

Course Name: ENGINEERING THERMODYNAMICS

Course Code	**21ME44**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Credits	**03**	**Exam Hours**	**03**
Total Number of Pedagogy Hours	**40**	**Total Marks**	**100**

Pre-requisites: Knowledge of Basic mathematics and sciences.

Module – 1

Fundamental Concepts & Definitions: Thermodynamic definition and scope, Microscopic and Macroscopic approaches. Some practical applications of engineering thermodynamic Systems, Characteristics of system boundary and control surface, examples. Thermodynamic properties; definition and units, intensive, extensive properties, specific properties, pressure, specific volume, Thermodynamic state, state point, state diagram, path and process, quasi-static process, cyclic and non-cyclic; processes; Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium, zeroth law of thermodynamics: Temperature; scales, thermometry, Importance of temperature measuring instruments. Design of Thermometers. **(self-study only not for SEE)**

Work and Heat: Mechanics, definition of work and its limitations. Thermodynamic definition of work; examples, sign convention. Displacement work; as a part of a system boundary, as a whole of a system boundary, expressions for displacement work in various processes through p-v diagrams. Heat; definition, units and sign convention. Problems.

First Law of Thermodynamics: Joules experiments, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law to non - cyclic processes, energy as a property, Extension of the First law to control volume; steady flow energy equation (SFEE), important applications.

8 Hours

Module – 2

Second Law of Thermodynamics: Limitations of first law of thermodynamics, Thermal reservoir, heat engine and heat pump: Schematic representation, efficiency and COP. Reversed heat engine, schematic representation, importance and superiority of a reversible heat engine. Kelvin - Planck statement of the Second law of Thermodynamics; PMM I and PMM II, Clausius statement of Second law of Thermodynamics, Equivalence of the two statements; Carnot cycle, Carnot principles. Problems

Entropy: Clausius inequality, Statement- proof, Entropy- definition, a property, change of entropy, entropy as a quantitative test for irreversibility, principle of increase in entropy, entropy as a coordinate. Numerical problems

8 Hours

Module – 3

Introduction and Review of Ideal and Real gases: Ideal gas mixtures, Daltons law of partial pressures, Amagats law of additive volumes, Evaluation of properties of ideal gases. Real gases: introduction, Van-Der Waal's equation, Van-Der Waal's constants in terms of critical properties. **(self-study only not for SEE)**

Combustion thermodynamics: Theoretical (Stoichiometric) air for combustion of fuels, excess air, actual combustion. Exhaust gas analysis. A/F ratio, energy balance for a chemical reaction, enthalpy of formation, enthalpy and internal energy of combustion, adiabatic flame temperature, combustion

I.C.Engines: Classification of IC engines, Combustion of SI engine and CI engine, Detonation and factors affecting detonation, Performance analysis of I.C Engines, Heat balance, Morse test.

8 Hours

Module – 4

Pure substance: P-T and P-V diagrams, triple point and critical points. Sub-cooled liquid, saturated liquid, mixture of saturated liquid and vapour, saturated vapour and superheated vapour states of pure substance with water as example. Enthalpy of change of phase (Latent heat). Dryness fraction (quality), T-S and H-S diagrams, representation of various processes on these diagrams. Steam tables and its use. Throttling calorimeter, separating and throttling calorimeter.

Vapour Power Cycles: Carnot vapour power cycle, simple Rankine cycle, actual vapour power cycles, ideal and practical regenerative Rankine cycles, open and closed feed water heaters, Reheat Rankine cycle and characteristics of an Ideal working fluid in vapour power cycles.

8 Hours

Module – 5

Gas power cycles: Air standard cycles-Otto cycle, Diesel cycle and Dual cycle, computation of thermal efficiency and mean effective pressure, comparison of Otto, Diesel & Dual cycles.

Gas turbine Cycles: Introduction and classification of gas turbine, gas turbine (Brayton) cycle; description and thermal analysis and methods to improve thermal efficiency of gas turbines, Jet Propulsion-Turbo jet, Ram jet Turbo prop and Rocket engine.

8 Hours

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Describe the fundamental concepts and principles of engineering thermodynamics.
CO2	Apply the governing laws of thermodynamics for different engineering applications.
CO3	Interpret behaviour of pure substances and its application to practical problems.
CO4	Analyse the various thermodynamic process, cycles and results.
CO5	Apply thermodynamic concept to analyze performance of Gas power cycle and gas turbines.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Basics and applied thermodynamics	P K Nag	Tata McGraw HillPublications	2017
2	A text book of Engineering Thermodynamics	R K Rajput	Laxmi Publications	2019
3	Thermodynamics, AnEngineering Approach	Yunus A Cengel	Tata Mcgraw HillPublications	2019
Reference Books				
1	Engineering Thermodynamics	J B Jones and G A Hawkins	John Wiley	1986
2	An Introduction to Thermodynamics	Y V C Rao	Wiley Eastern	2003
3	Applications of Thermodynamics	Dr.V K Kadambi and Dr T RSeetharam	Wiley Publications	2018

SEMESTER - IV

Course Name: **COMPUTER AIDED MACHINE DRAWING**

Course Code	**21MEL45**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**0:0:2**	**SEE Marks**	**50**
Credits	**01**	**Exam Hours**	**03**
Total Number of Pedagogy Hours	**20**	**Total Marks**	**100**

Pre-requisites: Engineering Drawing, Awareness of how various mechanical components function.

PART-A

Module – 1

Introduction: Review of basic concepts of Engineering Visualization.
Geometrical Dimensioning and Tolerances (GD&T): Introduction, Fundamental tolerances, Deviations, Methods of placing limit dimensions, machining symbols, types of fits with symbols and applications, geometrical tolerances on drawings. Standards are followed in the industry.
Conversion of pictorial views into **orthographic projections** of simple machine parts.

02 Hours

Module – 2

Thread Forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External), BSW, square, Acme, and American Standard thread.
Fasteners: Hexagonal-headed bolt and nut with washer (assembly), square-headed bolt and nut with washer (assembly), simple assembly using stud bolts with nut and lock nut.

03 Hours

PART-B

Module – 3

Riveted joints: Single and double riveted lap joints, Butt joints with single/double cover straps (Chain and zigzag using snap head riveters).
Welded Joints: Lap, Butt, T-shape **(Open-Ended Exercise)**

03 Hours

Module – 4

Assembly of Joints, Couplings using a 2D environment
Joints: Cotter joint (socket and spigot), Knuckle joint (pin joint) for two rods.
Couplings: Protected type flange coupling, Pin (bush) type flexible coupling, and Oldham's coupling.

04 Hours

PART-C

Module – 5

Assembly of Machine Components (with GD&T) using a 3D environment

1. Plummer Block (Pedestal Bearing)
2. Machine vice
3. I.C. Engine Connecting rod
4. Screw Jack (bottle type)
5. Lathe Square Tool Post
6. Tailstock of Lathe

08 Hours

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Interpret the Machining and surface finish symbols on the component drawings.
CO2	Demonstrate the role of limits and tolerance on the machine parts using 2D environment.
CO3	Exhibit the importance of functional and visualization aspects of part drawings.
CO4	Illustrate various machine components through drawings.
CO5	Interpret assembly drawings as per the conventions using 3D modeling.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Machine Drawing	K R Gopal Krishna	Subhash	2005
2	Machine Drawing	K L Narayan	New Age International	3rd and 2006
Reference Books				
1	Machine Drawing	N D Bhatt	Charotar Publishing House Pvt. Ltd	50th and 2014
2	Machine Drawing	P S Gill	S K Kataria and sons	2013
3	Machine Drawing	Ajeet Singh	Tata McGraw-Hill	2012

Semester: IV

Course Name: FLUID MECHANICS LAB

Course Code	**21MEL46**	**CIE Marks**	**50**
Teaching Hour / Week (L:T:P)	**0:0:2**	**SEE Marks**	**50**
Credits	**01**	**Exam Hours**	**03**
Total Number of Pedagogy Hours	**20**	**Total Marks**	**100**

Pre-requisites: Measurements and Instrumentation, Fluid mechanics

PART-A

1. Determination of Coefficient of Friction of flow through a pipe.
2. Determination of Minor losses in the pipe.
   - ❖ Head loss due to bend
   - ❖ Head loss due to EL-bow
   - ❖ Head loss due to sudden contraction.
   - ❖ Head loss due to sudden enlargement.
3. To verify Bernoulli's equation by demonstrating the relationship between pressure head and kinetic head. **(Open-Ended Experiment)**
4. Impact of Jets – Flat, Inclined and Curved vanes
5. Calibration of collecting tank by volumetric method. **(Open-Ended Experiment)**

PART-B

1. Calibration of Venturimeter to evaluate the coefficient of discharge
2. Discharge measurement using Orifice meter.
3. Calibration of triangular notch to evaluate the coefficient of discharge.
4. Calibration of rectangular notch to evaluate the coefficient of discharge.
5. To determine coefficient of discharge of vertical Orifice **(Open-Ended Experiment).**

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO 1	Determine flow measurements and classify minor losses.
CO 2	Apply Pipe friction formula to determine major losses.
CO 3	Evaluate the performance of pipe to determine the co-efficient of friction.
CO 4	Estimate the data in determining forces of various types in impact of jets.
CO 5	Perform experiments on flow measurements.

Semester: III / IV

Course Name: CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND CYBER LAW

Course Code	**21CIP37/47**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**1-0-0**	**SEE Marks**	**50**
Credits	**01**	**Exam Hours**	**02**
Total Hours of Pedagogy	**15**	**Total Marks**	**100**

Module – 1

Introduction to Indian Constitution
The Making of the Constitution, The Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India. Fundamental Rights. Directive Principles of State Policy (DPSP). Fundamental Duties.

03 Hours

Module - 2

Union Executive and State Executive:
Parliamentary System, Federal System, Union Executive – President, Prime Minister, Union Cabinet, Parliament – Union Legislature, Lok Sabha and Rajya Sabha types of bills. Union judiciary Supreme Court of India.

03 Hours

Module – 3

Elections, Amendments and Emergency Provisions Elections, Electoral Process, and Election Commission of India, Election Laws. Amendments - Methods in Constitutional Amendments. Important Constitutional Amendments. Amendments – 7,9,10,12,42,44, 61, 73,74, ,75, 86, and 91,94,95,100,101,118. Emergency Provisions, types of Emergencies and its consequences. Special Provisions (Articles 370.371,371J) for some States

03 Hours

Module – 4

Professional / Engineering Ethics: Scope & Aims of Engineering & Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Role morality. What is profession characteristic of profession? The NSPE board of Professional ethics. Engineering ethics as preventive ethics. Responsible Engineer. Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. What is conflict of interest? Honesty integrity and reliability. IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering.

03 Hours

Module – 5

Internet Laws, Cyber Crimes and Cyber Laws: Internet and Need for Cyber Laws, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000. Cybercrimes and enforcement agencies.

03 Hours

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Demonstrate constitutional knowledge and legal literacy.
CO2	Understand Engineering and Professional ethics and responsibilities of Engineers
CO3	Understand the cybercrimes and cyber laws for cyber safety measures

Suggested Learning Resources:

Text Books

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Constitution of India, Professional Ethics and Human Rights Shubham Singles	Charles E. Haries, and et al	Cengage Learning India	2018
2	Introduction to the Constitution of India	Durga Das Basu	Prentice –Hall	2008
3	Engineering Ethics	M. Govindarajan, S. Natarajan, V. S. Senthilkumar	Prentice –Hall	2004

Reference Books

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Cyber Security and Cyber Laws	Alfred Basta and et al	Cengage Learning India	2018

Semester: IV

Course Name: SOFT SKILLS AND BASIC APTITUDE

Course Code	**21SSA480**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**1:2:0**	**SEE Marks**	**50**
Credits	**2**	**Exam Hours**	**02**
Total Hours of Pedagogy	**30**	**Total Marks**	**100**

Pre-requisites:

- Basic Conversational English
- Fundamentals of Mathematics
- Basic Knowledge of Reasoning

Module – 1

Communication Skills

Basic Tools of Communication, Listening Skills, Body Language, Voice, Verbal Language, Conversations in Professional Setting

06 Hours

Module – 2

Presentation Skills

Zero Presentation, Individual Presentations, Feedback, Types of Introductions, Captivating the Audience, Interaction Methods, Signing off.

06 Hours

Module – 3

Verbal & Numerical Ability

Vocabulary is Fun, Root Words, Sentence Structures, Bouncing, Similar and Opposite Words, Common Errors, Number System, Factors and Multiples.

06 Hours

Module – 4

English Language

Phonetic and Non-phonetic Languages, sounds in English, IPA, Syllables, Word Stress, Stress patterns in Indian languages vs English, Pausing and Rhythm in English, Sentence Structures, Bouncing, Common Errors

06 Hours

Module – 5

Verbal Ability and Verbal Reasoning

Similar and Opposite words, Number and Alphabet Series, Human Relations, Direction Tests, Coding Decoding, Clocks and Calendars

06 Hours

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Demonstrate communicative ability in a professional environment
CO2	Articulate one's ideas and demonstrate them to an audience
CO3	Transform one's English Vocabulary and Language Structure
CO4	Interpret international phonetic symbols, stress patterns, and enhance English speech
CO5	Identify patterns, determine the problem-solving process & validate solutions

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Reasoning N' Reasoning - Verbal & Non-verbal Reasoning	Dr. Ravi Chopra	Galgotia	1994
2	Magical Book on Quicker Math	M. Tyra	BSC	I Edition, 2018
3	Communicate with Confidence	Diana Booher	Mc-Graw-Hill	Nov 2011
Reference Books				
1	Cambridge Advanced Learner's Dictionary	Cambridge University Press	CBS	IV Edition, 2013
2	A Modern Approach to Verbal and Non-verbal Reasoning	R S Agarwal	S Chand	II Edition, 2018
3	Word Power Made Easy	Norman Lewis	Goyal Publishers	IV Edition, 2014
4	Speak with Confidence	Diana Booher	Mc-Graw-Hill	I Edition, 2002

Semester: IV

Course Name: BIOLOGY FOR ENGINEERS

Course Code	**21ABE481**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**1:0:0**	**SEE Marks**	**50**
Credits	**01**	**Exam Hours**	**02**
Total Hours of Pedagogy	**15**	**Total Marks**	**100**

Module – 1

BIOMOLECULES AND THEIR APPLICATIONS (QUALITATIVE):
Carbohydrates (cellulose-based water filters, PHA and PLA as bioplastics), Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics – DNA fingerprinting), Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins), lipids (biodiesel, cleaning agents/detergents), Enzymes (glucose-oxidase in biosensors, lignolytic enzyme in bio-bleaching).

06 Hours

Module – 2

HUMAN ORGAN SYSTEMS AND BIO DESIGNS - 1 (QUALITATIVE):
Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease). Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye). Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators).

06 Hours

Module – 3

HUMAN ORGAN SYSTEMS AND BIO-DESIGNS - 2 (QUALITATIVE):
Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine). Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems). Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis).

06 Hours

Module – 4

NATURE-BIOINSPIRED MATERIALS AND MECHANISMS (QUALITATIVE):
Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train). Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perflourocarbons (PFCs).

06 Hours

Module – 5

TRENDS IN BIOENGINEERING (QUALITATIVE):
Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing,

Bioimaging and Artificial Intelligence for disease diagnosis. Self- healing Bioconcrete (based on bacillus spores, calcium lactate nutrients and biomineralization processes) and Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic).

06 Hours

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Elucidate the basic biological concepts via relevant industrial applications and case studies.
CO2	Evaluate the principles of design and development, for exploring novel bioengineering projects.
CO3	Corroborate the concepts of biomimetics for specific requirements.
CO4	Think critically towards exploring innovative biobased solutions for socially relevant problems.

Semester: IV

Course Name: INTRODUCTION TO COMPUTER GRAPHICS

Course Code	21AME482	CIE Marks	50
Teaching Hours/Week (L:T:P)	1:0:0	SEE Marks	50
Credits	01	Exam Hours	02
Total Number of Pedagogy Hours	15	Total Marks	100

Pre-requisites:
Mathematics – Linear algebra
Computer fundamentals

Module - 1

Types and Mathematical Representation of Curves:
Curve representation. Parametric representation of Analytic Curves: Lines, Circles, Ellipse, Bezier curves, B-spline curves

03 Hours

Module - 2

Scan Conversion: Drawing Algorithms: DDA algorithm, Bresenham's integer line algorithm, Bresenham's circle algorithm: mid-point line and circle algorithms.

03 Hours

Module – 3

2D Transformations: Representation of points & lines. Transformations: translation, scaling, rotation, reflection and concatenations. Rotation about an arbitrary point and an arbitrary line.

03 Hours

Module – 4

Visual Realism-I: Introduction, hidden line removal, Visibility of object views, Visibility techniques: minimax test, Surface test, Silhouttes, Homogeneity test, Sorting, Coherence.

03 Hours

Module – 5

Data Exchange and Animation: Evolution of data exchange, IGES, PDES. Conventional animation: key frame, In-betweening, Line testing, Painting, Filming. Computer animation, Entertainment and engineering animation.

03 Hours

COURSE OUTCOMES:
At the end of the course, the student will be able to:

CO1	Develop expertise in generation of curves.
CO2	Apply algorithms for drawing 2D images.
CO3	Analyze transformation on 2D images.
CO4	Explain the projection and hidden surface removal algorithms.
CO5	Interpret the concepts of data exchange and animation.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	CAD/CAM	Ibrahim Zeid	Tata McGraw Hill.	
2	CAD / CAM Principles and Applications	P N Rao	Tata McGraw-Hill	3rd 2015 Edition,
3	CAD/CAM/CIM	Dr. P. Radhakrishnan	New Age International New Delhi.	3rd edition
4	Mathematical Elements of Computer Graphics	Roger Adams, J. Alan Adams	Mc-Graw Hill, 2nd edition	2017
5	Computer Graphics	Schaums outlines	Mc-Graw Hill	2015

Semester: IV

Course Name: UNIVERSAL HUMAN VALUES: UNDERSTANDING HARMONY & ETHICAL HUMAN CONDUCT

Course Code	**21UHV490**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**1:0:0**	**SEE Marks**	**50**
Credits	**1**	**Exam Hours**	**02**
Total Number of Pedagogy Hours	**15**	**Total Marks**	**100**

Module – 1

Introduction to Value Education Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations

03 Hours

Module - 2

Harmony in the Human Being

Understanding Human being as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health

03 Hours

Module – 3

Harmony in the Family and Society

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order

3-Hours

Module – 4

Harmony in the Nature/Existence

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence

03 Hours

Module – 5

Implications of the Holistic Understanding – a Look at Professional Ethics

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

03 Hours

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Develop personality with responsibilities and self-respect.
CO2	Build real world skills like communication, lifelong-learning and problem-solving.
CO3	Create harmonious relationship among faculty and students.
CO4	Provide an organized philanthropic service to the society through activities.
CO5	Create awareness on health, yoga, human relationships, universal peace, environment, society and nation.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	A Foundation Course in Human Values and Professional Ethics	R R Gaur, R Asthana, G P Bagaria	Excel Books	2nd Revised Edition New Delhi, 2019
2	The Teachers manual	-	-	-
Reference Books				
1	JeevanVidya: EkParichaya	A Nagaraj	JeevanVidyaPrakashan, Amarkantak	1999
2	Human Values	A.N. Tripathi	New Age Intl. Publishers, New Delhi	2004
3	The Story of Stuff (Book)	-	-	-
4	The Story of My Experiments with Truth	Mohandas Karamchand Gandhi	-	-
5	Small is Beautiful	E. F Schumacher	-	-
6	Slow is Beautiful	Cecile Andrews	-	-
7	Economy of Permanence	J C Kumarappa	-	-

Semester: IV

Course Name: **ADDITIONAL MATHEMATICS-II**

Course Code	**21MATDIP41**	**CIE Marks**	**100**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**--**
Credits	**00**	**Exam Hours**	**00**

Pre-requisites: Differentiation, Integration, Trigonometric formulae, Differential equations.

Module – 1

Higher Order ODE's
Linear Differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators. [Particular integral restricted to $\phi(x) = e^{ax}, Sinax, Cosax$ for $f(D)y = \phi(x)$
Self-Study: Finding particular Integral for $\phi(x) = x^m$

08 Hours

Module - 2

Partial Differential Equations (PDE's):
Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct by integration. Homogeneous PDE involving derivative with respect to one independent variable only.
Self-Study: Method of separation of variables

08 Hours

Module – 3

Laplace Transform:
Definition, Laplace transforms of elementary functions. Laplace transform of $e^{at}f(t)$, $t^n f(t)$ (without proof). Laplace transform of Periodic functions (statement only) and Unit-step function- problems.
Inverse Laplace Transform: Definition**,** Inverse Laplace Transform of standard functions. Inverse transform by Partial fraction Method. Apply the concepts of Laplace Transforms to find the solution of linear differential equations.
Self-Study: Convolution Theorem

08 Hours

Module – 4

Numerical Methods:
Solution of algebraic and transcendental equations by Newton-Raphson method and Secant method.
Interpolation: Newton's Forward and Backward Interpolation formulae, Newton's divided difference formula, Lagrange's Interpolation formula-problems.
Numerical Integration: Simpson's 1/3rd and 3/8th rule (without proof) - problems.
Self-Study: Weddle's Rule

08 Hours

Module – 5

Probability:
Introduction, sample space and events. Axioms of probability. Addition & multiplication theorems. Conditional probability, Baye's theorem. Problems.
Self-Study: Applications Baye's theorm

08 Hours

COURSE OUTCOMES:
At the end of the course, the student will be able to:

CO1	Demonstrate various physical models through higher order differential equations and solve such linear ordinary differential equations.
CO2	Construct a variety of partial differential equations and solution by various methods.
CO3	Use Laplace Transform and inverse Laplace Transform in solving differential /integral equation arising in network analysis, control systems and other fields of engineering.
CO4	Apply the knowledge of numerical methods in the modeling of various physical and engineering phenomena.
CO5	Use the concepts of probability in different probability distribution.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Higher Engineering Mathematics	B.S.Grewal	Khanna Publishers	43rd Ed.2015
2	Advanced Engineering Mathematics	E. Kreyszig	Jhon willy & Sons	10th Ed. (Reprint).2016
3	Additional Mathematics-2	Dr. Pandurangappa	Sanguine Technical Publishers	4Th Ed., 2019.
Reference Books				
1	Higher Engineering Mathematics	B.V.Ramana	Tata McGraw-Hill	11th Edition.2010

Pedagogy / Teaching-Learning Process (which are appropriately selected):

1. Adopt different type of teaching methods to develop the outcomes through Power-Point Presentation and Video demonstration or Simulations.
2. Disquisition method for Problem Solving.
3. Arrange visits to show the live working models other than laboratory topics.
4. Adopt collaborative Learning (Group Learning) in the class.
5. Adopt Problem Based Learning (PBL), which fosters students ‘Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information.
6. Conduct Laboratory Demonstrations and Practical Experiments to enhance experiential skills.

Assessment Details for IPCC

Continuous Internal Evaluation (CIE): CIE for the theory component of IPCC is 30 marks

Sl. No.	Components	Number	Weightage	Max. Marks
1	Tests (A)	3*	60%	18
2	Alternate Assessment Tools (AAT) (B)	3-4	40%	12
	Total Marks for theory component A+B			**30**

CIE for the LAB component of IPCC: 20 marks

Sl. No.	Components	Weightage	Max. Marks
1	Lab Work: Conduction of Experiments (A)	40%	08
2	Lab Journal Writing & Submission (B)	10%	02
3	Lab Test (C)	30%	06
4	Open-Ended Experiments / Mini Lab Projects (D)	20%	04
	Total Marks		**20**

Final CIE Marks = CIE for theory component + CIE for Lab component

Semester End Examination (SEE)

SEE for IPCC Theory for 3 hours duration

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)
- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Assessment Details for PCC

CIE:

Tests (A): Topics taught by Lecture hours need to be assessed and this will contribute to 30 marks.

	Components	**Number**	**Weightage**	**Max. Marks**
(i)	Tests (A)	3*	60%	30
(ii)	Alternate Assessment Tools (AAT) (B)	3-4	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

Semester End Examination (SEE)

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

ABILITY ENHANCEMENT COURSE (AEC):

Assessment Details of CIE

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3	60%	30
(ii)	Alternate Assessment Tools (AAT) (B)	3	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B)

Semester End Examination (SEE): SEE Guidelines for the Courses

a. 21CIP37/47 - Constitution of India, professional Ethics and Cyber Law

b. 21DTI39 - Design Thinking and Innovation

c. 21SSA480 - Soft Skills and Basic Aptitude

d. 21ABE481 - Biology for Engineers

e. 21AME482 - Introduction to Computer Graphics

f. 21UHV490 - Universal Human Values

1. SEE will be conducted with common question papers for the subject.
2. SEE Pattern will be in MCQ Model (Multiple Choice Questions) for 100 marks which will be scaled down to 50 marks.
3. Duration of the examination is 02Hours

FOR THE COURSES:

a. 21MATDIP31 / 41 – Additional mathematics I and II

b. 21KSK37/47 – Samskrutika Kannada

c. 21KBK37/47 - Balake Kannada

Continuous Internal Evaluation (CIE):

	Components	Number	Weightage	Max. Marks
(i)	Tests (**A**)	3	60%	60
(ii)	Alternate Assessment Tools (AAT) (**B**)	3	40%	40
	Total Marks			**100**

Semester End Examination (SEE): There is no SEE for the above Courses

Alternate Assessment Tools (AAT)
The following are the Alternate Assessment Tools (AAT) and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem-based learning.

Assessment Details for PRACTICAL

Continuous Internal Evaluation (CIE)

	Components	Weightage	Max. Marks
1.	Lab Work: Conduction of Experiments (A)	40%	20
2.	Lab Journal Writing & Submission (B)	10%	05
3.	Lab Test (C)	30%	15
4.	Open-Ended Experiments / Mini Lab Projects (D)	20%	10
	Total Marks		**50**

Semester End Examination (SEE)

Semester end examination (SEE) will be conducted for 100 marks and proportionally reduced to 50 marks.

The pattern of SEE and scheme of evaluation:

Sl. No.	Components	Max. Marks
1	One Experiment from Part – A	**30**
2	One Experiment from Part – B	**50**
3	Viva – Voce	**20**
	Total	**100**

Question paper pattern:

- All the experiments are included for the external practical examination.
- There will be two parts A, B one question from each section need to be answered.
- **Part A** carries 40% and **Part B** carries 60%
- **Marks distribution**: **Procedure** (20%) + **Execution** (60%) + Viva Voce (20%)
- Students can pick one experiment from the questions lot prepared by the examiners.

- Change of experiment is allowed only once and 50% marks allotted to the procedure part to be made zero.

FOR THE COURSE:

a. 21MEL45 – Computer Aided Machine Drawing

SEE question paper will be set for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

1. The question paper will have **4 full questions**.
   a) Two full questions from **Module-4** carrying 40 marks each. For each question 20 marks are allocated for Solution and sketching, and 20 marks for computer display and printout.
   b) Two questions from **Module-5** carrying 60 marks each. For each question 20 marks are allocated for Solution and sketching, and 40 marks for computer display and printout.
   c) **Modules 1 to 3** are for CIE component only.
2. The students will have to answer **2 full questions**, selecting one full question from each module.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY
BELAGAVI

MECHANICAL ENGINEERING

BE/B.Tech. Scheme of Teaching and Examinations

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2018 – 19)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

Scheme of Teaching and Examination 2018 – 19

Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2018 – 19)

III SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week: Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	BSC	18MAT31	Transform calculus, fourier series and Numerical techniques	Mathematics	2	2	--	03	40	60	100	3
2	PCC	18ME32	Mechanics of Materials		3	2	--	03	40	60	100	4
3	PCC	18ME33	Basic Thermodynamics		3	0	--	03	40	60	100	3
4	PCC	18ME34	Material Science		3	0	--	03	40	60	100	3
5	PCC	18ME35A or	Metal cutting and forming		3	0	--	03	40	60	100	3
		18ME35B	Metal Casting and Welding									
6	PCC	18ME36A or	Computer Aided Machine Drawing/		1	4	--	03	40	60	100	3
		18ME36B	Mechanical Measurements and Metrology		3	0						
7	PCC	18MEL37A or	Material Testing lab		--	2	2	03	40	60	100	2
		18MEL37B	Mechanical Measurements and Metrology lab									
8	PCC	18MEL38A	Workshop and Machine Shop Practice (Consists of Fitting, and Machining)		--	2	2	03	40	60	100	2
		18MEL38B	Foundry,Forging and Welding lab									
9	HSMC	18KVK39/49	Vyavaharika Kannada (Kannada for communication)/	HSMC	--	2	--	--	100	--	100	1
		18KAK39/49	Aadalitha Kannada (Kannada for Administration)									
		OR										
		18CPC39	Constitution of India, Professional Ethics and Cyber Law		1	--	--	02	40	60		
					Examination is by objective type questions							
				TOTAL	**17 OR 19**	**10 OR 14**	**04**	**24 OR 26**	**420 OR 360**	**480 OR 540**	**900**	**24**

Note: BSC: Basic Science, PCC: Professional Core, HSMC: Humanity and Social Science, NCMC: Non-credit mandatory course.

18KVK39 Vyavaharika Kannada (Kannada for communication) is for non-Kannada speaking, reading and writing students and 18KAK39 Aadalitha Kannada (Kannada for Administration) is for students who speak, read and write Kannada.

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

10	NCMC	18MATDIP31	Additional Mathematics - I	Mathematics	02	01	--	03	40	60	100	0

a) The mandatory non – credit courses Additional Mathematics I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE/B. Tech programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the University examination. In case, any student fails to register for the said course/ fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured F grade. In such a case, the students have to fulfill the requirements during subsequent semester/s to appear for SEE.

b) These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

Courses prescribed to lateral entry B. Sc degree holders admitted to III semester of Engineering programs

Lateral entrant students from B.Sc. Stream, shall clear the non-credit courses Engineering Graphics and Elements of Civil Engineering and Mechanics of the First Year Engineering Programme. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2018 – 19
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2018 – 19)

IV SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week: Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	BSC	18MAT41	Mathematics	Mathematics	2	2	--	03	40	60	100	3
2	PCC	18ME42	Applied Thermodynamics		3	2	--	03	40	60	100	4
3	PCC	18ME43	Fluid Mechanics		3	0	--	03	40	60	100	3
4	PCC	18ME44	Kinematics of Machines		3	0	--	03	40	60	100	3
5	PCC	18ME45A	Metal cutting and forming		3	0	--	03	40	60	100	3
		18ME45B	Metal Casting and Welding									
6	PCC	18ME46A or	Computer Aided Machine Drawing/		1	4	--	03	40	60	100	3
		18ME46B	Mechanical Measurements and Metrology		3	0						
7	PCC	18MEL47A or	Material Testing lab		--	2	2	03	40	60	100	2
		18MEL47B	Mechanical Measurements and Metrology lab									
8	PCC	18MEL48A	Workshop and Machine Shop Practice (Consists of Fitting, and Machining)		--	2	2	03	40	60	100	2
		18MEL48B	Foundry, Forging and Welding lab									
9	HSMC	18KVK49/49	Vyavaharika Kannada (Kannada for communication)/	HSMC	--	2	--	--	100	--	100	1
		18KAK49/49	Aadalitha Kannada (Kannada for Administration)									
		OR										
		18CPH49	Constitution of India, Professional Ethics and Cyber Law		1	--	--	02	40	60		
					Examination is by objective type questions							
				TOTAL	17 OR 19	10 OR 14	04	24 OR 26	420 OR 360	480 OR 540	900	24

18KVK39 Vyavaharika Kannada (Kannada for communication) is for non-Kannada speaking, reading and writing students and 18KAK39 Aadalitha Kannada (Kannada for Administration) is for students who speak, read and write Kannada.

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

10	NCMC	18MATDIP31	Additional Mathematics - I	Mathematics	02	01	--	03	40	60	100	0

(a) The mandatory non – credit courses Additional Mathematics I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE/B. Tech programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the University examination. In case, any student fails to register for the said course/ fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured F grade. In such a case, the student have to fulfill the requirements during subsequent semester/s to appear for SEE.

(b) These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

Courses prescribed to lateral entry B. Sc degree holders admitted to III semester of Engineering programs

Lateral entrant students from B.Sc. Stream, shall clear the non-credit courses Engineering Graphics and Elements of Civil Engineering and Mechanics of the First Year Engineering Programme. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

Scheme of Teaching and Examination 2018 – 19

Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2018 – 19)

V SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	18ME51	Management and Economics		2	2	--	03	40	60	100	3
2	PCC	18ME52	Design of Machine Elements I		3	2	--	03	40	60	100	4
3	PCC	18ME53	Dynamics of Machines		3	2	--	03	40	60	100	4
4	PCC	18ME54	Turbo Machines		3	--	--	03	40	60	100	3
5	PCC	18ME55	Fluid Power Engineering		3	--	--	03	40	60	100	3
6	PCC	18ME56	Operations Management		3	--	--	03	40	60	100	3
7	PCC	18MEL57	Fluid Mechanics/Machines lab		--	2	2	03	40	60	100	2
8	PCC	18MEL58	Energy Conversion Lab		--	2	2	03	40	60	100	2
9	HSMC	18CIV59	Environmental Studies	Civil/ Environmental [Paper setting: Civil Engineering Board]	1	--	--	02	40	60	100	1
				TOTAL	**18**	**10**	**04**	**26**	**360**	**540**	**900**	**25**

Note: PCC: Professional Core, HSMC: Humanity and Social Science.

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2018 – 19
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2018 – 19)

VI SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	18ME61	Finite Element Methods		3	2	--	03	40	60	100	4
2	PCC	18ME62	Design of Machine Elements II		3	2	--	03	40	60	100	4
3	PCC	18ME63	Heat Transfer		3	2	--	03	40	60	100	4
4	PEC	18ME64X	Professional Elective -1		3	--	--	03	40	60	100	3
5	OEC	18ME65X	Open Elective -A		3	--	--	03	40	60	100	3
6	PCC	18MEL66	Computer Aided Modelling and Analysis Lab		--	2	2	03	40	60	100	2
7	PCC	18MEL67	Heat Transfer Lab		--	2	2	03	40	60	100	2
8	MP	18MEMP68	Mini-project		--	--	2	03	40	60	100	2
9	Internship	--	Internship	To be carried out during the vacation/s of VI and VII semesters and /or VII and VIII semesters.								
				TOTAL	**15**	**10**	**06**	**24**	**320**	**480**	**800**	**24**

Note: PCC: Professional core, PEC: Professional Elective, OE: Open Elective, MP: Mini-project.

Professional Elective -1

Course code under 18XX64X	Course Title	Course code under 18XX64X	Course Title
18ME641	**Non-Traditional Machining**	18ME644	**Vibrations and Noise Engineering**
18ME642	**Refrigeration and Air conditioning**	18ME645	**Composite Materials Technology**
18ME643	**Theory of Elasticity**	18ME646	**Entrepreneurship Development**

Open Elective -A

Students can select any one of the open electives offered by other Departments expect those that are offered by the parent Department (Please refer to the list of open electives under 18XX65X).
Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

Mini-project work:
Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:
(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.
The CIE marks awarded for the Mini-project work, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.
(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all the guides of the college.
The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

SEE for Mini-project:
(i) Single discipline: Contribution to the Mini-project and the performance of each group member shall be assessed individually in the semester end examination (SEE) conducted at the department.
(ii) Interdisciplinary: Contribution to the Mini-project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belongs to.

Internship: All the students admitted to III year of BE/B. Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements.

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VII SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	18ME71	Control Engineering		3	--	--	03	40	60	100	3
2	PCC	18ME72	Computer Aided Design and Manufacturing		3	--	--	03	40	60	100	3
3	PEC	18ME73X	Professional Elective - 2		3	--	--	03	40	60	100	3
4	PEC	18ME74X	Professional Elective - 3		3	--	--	03	40	60	100	3
5	OEC	18ME75X	Open Elective -B		3	--	--	03	40	60	100	3
6	PCC	18MEL76	Computer Integrated Manufacturing Lab		--	2	2	03	40	60	100	2
	PCC	18MEL77	Design Lab		--	2	2	03	40	60	100	2
7	Project	18MEP78	Project Work Phase - 1		--	--	2	--	100	--	100	1
8	Internship	--	Internship	(If not completed during the vacation of VI and VII semesters, it shall be carried out during the vacation of VII and VIII semesters)								
				TOTAL	**15**	**04**	**06**	**18**	**340**	**360**	**700**	**20**

Professional Elective - 2

Course code under 18XX73X	Course Title	Course code under 18XX73X	Course Title
18ME731	**Design for Manufacture**	18ME734	**Total Quality Management**
18ME732	**Automation and Robotics**	18ME735	**Operations Research**
18ME733	**Computational Fluid Dynamics**		

Professional Electives - 3

Course code under 18XX74X	Course Title	Course code under 18XX74X	Course Title
18ME741	**Additive Manufacturing**	18ME744	**Mechatronics**
18ME742	**Emerging Sustainable Building Cooling Technologies**	18ME745	**Project Management**
18ME743	**Theory of Plasticity**		

Open Elective -B

Students can select any one of the open electives offered by other Departments expect those that are offered by the parent Department (Please refer to the list of open electives under 18XX75X).
Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

Project work:
Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary project can be assigned to an individual student or to a group having not more than 4 students. In extraordinary cases, like the funded projects requiring students from different disciplines, the project student strength can be 5 or6.

CIE procedure for Project Work Phase - 1:
(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.
The CIE marks awarded for the project work phase -1, shall be based on the evaluation of the project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the Project report shall be the same for all the batch mates.
(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable.
The CIE marks awarded for the project work phase -1, shall be based on the evaluation of project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.
Internship: All the students admitted to III year of BE/B. Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the Internship requirements.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2018 – 19
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VIII SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	18ME81	**Energy Engineering**		3	--	--	03	40	60	100	3
2	PEC	18ME82X	**Professional Elective - 4**		3	--	--	03	40	60	100	3
3	Project	18MEP83	**Project Work Phase - 2**		--	--	2	03	40	60	100	8
4	Seminar	18MES84	**Technical Seminar**		--	--	2	03	100	--	100	1
5	Internship	18XXI85	Internship	Completed during the vacation/s of VI and VII semesters and /or VII and VIII semesters.)				03	40	60	100	3
				TOTAL	**06**	--	**04**	**15**	**260**	**240**	**500**	**18**

Note: PCC: Professional Core, PEC: Professional Elective.

Professional Electives - 4

Course code under 18XX82X	Course Title	Course code under 18XX82X	Course Title
18ME821	**CNC Machine Tools**	18ME824	**Automobile Engineering**
18ME822	**Tribology**	18ME825	**Tool Design**
18ME823	**Non-Destructive Testing and Evaluation**	18ME826	**Fracture Mechanics**

Project Work

CIE procedure for Project Work Phase - 2:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable.

The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

SEE for Project Work Phase - 2:

(i) **Single discipline:** Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted at the department.

(ii) **Interdisciplinary:** Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belongs to.

Internship: Those, who have not pursued /completed the internship, shall be declared as fail and have to complete during subsequent University examination after satisfying the internship requirements.

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

Activity points of the students who have earned the prescribed AICTE activity Points shall be sent the University along with the CIE marks of 8th semester. In case of students who have not satisfied the AICTE activity Points at the end of eighth semester, the column under activity Points shall be marked NSAP (Not Satisfied Activity Points).

B.E. Mechanical Engineering Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER - VI			
OPEN ELECTIVE - A			
Course Code	18ME65X	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Students can select any one of the open electives offered by other Departments expect those that are offered by the parent Department (For syllabus, please refer to the concerned programme syllabus book or VTU website vtu.ac.in may be visited.).
Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

Sl. No.	Board and the Department offering the Electives		Course Sl. No.	Course code under 18XX65X	Course Title
1	ME	Mechanical Engineering	1	18ME651	**Non-Conventional Energy Sources**
			2	18ME652	**World Class Manufacturing**
			3	18ME653	**Supply Chain Management**
			4	18ME654	**Advanced Materials Technology**

B.E Mechanical Engineering Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER - VII			
OPEN ELECTIVE - B			
Course Code	18ME75X	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Students can select any one of the open electives offered by other Departments expect those that are offered by the parent Department (For syllabus, please refer to the concerned programme syllabus book or VTU website vtu.ac.in may be visited.).
Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

Sl NO	Board and the Department offering the Electives		Course Sl No	Course code under 18XX75X	Course Title
2	ME	Mechanical Engineering	1	18ME751	**Energy and Environment**
			2	18ME752	**Automotive Engineering**
			3	18ME753	**Industrial Safety**
			4	18ME754	**Optimization Techniques**

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES
(Common to all Programmes)

Course Code	**18MAT31**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	**03**	Exam Hours	03

Course Learning Objectives:

- To have an insight into Fourier series, Fourier transforms, Laplace transforms, Difference equations and Z-transforms.
- To develop the proficiency in variational calculus and solving ODE's arising in engineering applications, using numerical methods.

Module-1

Laplace Transforms: Definition and Laplace transform of elementary functions. Laplace transforms of Periodic functions and unit-step function – problems.
Inverse Laplace Transforms: Inverse Laplace transform - problems, Convolution theorem to find the inverse Laplace transform (without proof) and problems, solution of linear differential equations using Laplace transform.

Module-2

Fourier Series: Periodic functions, Dirichlet's condition. Fourier series of periodic functions period 2π and arbitrary period. Half range Fourier series. Practical harmonic analysis, examples from

Module-3

Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transforms. Simple problems.
Difference Equations and Z-Transforms: Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping and shifting rules, initial value and final value theorems (without proof) and problems, Inverse z-transform. Simple problems.

Module-4

Numerical Solutions of Ordinary Differential Equations (ODE's): Numerical solution of ODE's of first order and first degree- Taylor's series method, Modified Euler's method. Range - Kutta method of fourth order, Milne's and Adam-Bashforth predictor and corrector method (No derivations of formulae), Problems.

Module-5

Numerical Solution of Second Order ODE's: Runge -Kutta method and Milne's predictor and corrector method.(No derivations of formulae).
Calculus of Variations: Variation of function and functional, variational problems, Euler's equation, Geodesics, hanging chain, problems.

Course Outcomes:
At the end of the course the student will be able to:

- CO1: Use Laplace transform and inverse Laplace transform in solving differential/ integral equation arising in network analysis, control systems and other fields of engineering.
- CO2: Demonstrate Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
- CO3: Make use of Fourier transform and Z-transform to illustrate discrete/continuous function arising in wave and heat propagation, signals and systems.
- CO4: Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.
- CO5:Determine the extremals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10th Edition, 2016
2	Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers	44th Edition, 2017
3	Engineering Mathematics	Srimanta Pal et al	Oxford University Press	3rd Edition, 2016
Reference Books				
1	Advanced Engineering Mathematics	C. Ray Wylie, Louis C. Barrett	McGraw-Hill Book Co	6th Edition, 1995
2	Introductory Methods of Numerical Analysis	S. S. Sastry	Prentice Hall of India	4th Edition 2010
3	Higher Engineering Mathematics	B.V. Ramana	McGraw-Hill	11th Edition,2010
4	A Text Book of Engineering Mathematics	N. P. Bali and Manish Goyal	Laxmi Publications	2014
5	Advanced Engineering Mathematics	Chandrika Prasad and Reena Garg	Khanna Publishing,	2018

Web links and Video Lectures:

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU EDUSAT PROGRAMME - 20

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

MECHANICS OF MATERIALS

Course Code	**18ME32**	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

- To know the different types of stresses and strains developed in the member subjected to axial, bending, shear, torsion & thermal loads.
- To know behaviour & properties of engineering materials.
- To understand the stresses developed in bars, compounds bars, beams, shafts, and cylinders.
- To understand the concepts of calculation of shear force and bending moment for beams with different supports.
- To expose the students to concepts of Buckling of columns and strain energy.

Module-1

Stresses and Strains: Introduction, Properties of materials, Stress, Strain and Hooke's law, Stress strain diagram for brittle and ductile materials, True stress and strain, Calculation of stresses in straight, Stepped and tapered sections, Composite sections, Stresses due to temperature change, Shear stress and strain, Lateral strain and Poisson's ratio, Elastic constants and relations between them.

Module-2

Analysis of Stress and Strain: Introduction to three dimensional state of stress, Stresses on inclined planes, Principal stresses and maximum shear stress, Principal angles, Shear stresses on principal planes, Maximum shear tress, Mohr circle for plane stress conditions.

Cylinders: Thin cylinder: Hoop's stress, maximum shear stress, circumferential and longitudinal strains, Thick cylinders: Lames equations.

Module-3

Shear Force and Bending Moment: Type of beams, Loads and reactions, Relationship between loads, shear forces and bending moments, Shear force and bending moments of cantilever beams, Pin support and roller supported beams subjected to concentrated loads, uniformly distributed constant / varying loads.

Stress in Beams: Bending and shear stress distribution in rectangular, I and T section beams.

Module-4

Theories of Failure: Maximum Principal stress theory, Maximum shear stress theory.

Torsion: Circular solid and hallow shafts, Torsional moment of resistance, Power transmission of straight and stepped shafts, Twist in shaft sections, Thin tubular sections, Thin walled sections.

Module-5

Columns: Buckling and stability, Critical load, Columns with pinned ends, Columns with other support conditions, Effective length of columns,
Secant formula for columns.

Strain Energy: Strain energy due to axial, shear, bending, torsion and impact load. Castigliano's theorem I and II and their applications.

Course Outcomes: At the end of the course, the student will be able to:

- CO1: Understand simple, compound, thermal stresses and strains their relations and strain energy.
- CO2: Analyse structural members for stresses, strains and deformations.
- CO3: Analyse the structural members subjected to bending and shear loads.
- CO4: Analyse shafts subjected to twisting loads.
- CO5: Analyse the short columns for stability.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Mechanics of Materials	J M Gere, B J Goodno,	Cengage	Eighth edition 2013
2	Fundamentals of Strength of Materials	P N Chandramouli	PHI Learning Pvt. Ltd	2013
3	Strength of Materials	R K Rajput	S. Chand and Company Pvt. Ltd	2014
Reference Books				
1	Strength of Materials	R. Subramanian	Oxford	2005
2	Strength of Materials	S. S. Ratan	Tata McGraw Hill	2nd Edition, 2008
3	Mechanics of materials Strength of Materials	S C Pilli and N Balasubramanya	Cengage	2019
4	Mechanics of Materials	Ferdinand Beer, Russell Johston, John Dewolf, David Mazurek	McGraw Hill Education (India) Pvt. Ltd	Latest edition
5	Mechanics of Materials	R C Hibbeler	Pearson	Latest edition

B. E. MECHANICAL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - III			
BASIC THERMODYNAMICS			
Course Code	**18ME33**	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- Learn about thermodynamic system and its equilibrium
- Understand various forms of energy - heat transfer and work
- Study the basic laws of thermodynamics including, zeroth law, first law and second law.
- Interpret the behaviour of pure substances and its application in practical problems.
- Study of Ideal and real gases and evaluation of thermodynamic properties

Module-1

Fundamental Concepts & Definitions: Thermodynamic definition and scope, Microscopic and Macroscopic approaches. Some practical applications of engineering thermodynamic Systems, Characteristics of system boundary and control surface, examples. Thermodynamic properties; definition and units, intensive, extensive properties, specific properties, pressure, specific volume, Thermodynamic state, state point, state diagram, path and process, quasi-static process, cyclic and non-cyclic; processes;

Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium, Zeroth law of thermodynamics, Temperature; concepts, scales, international fixed points and measurement of temperature. Constant volume gas thermometer, constant pressure gas thermometer, mercury in glass thermometer.

Module-2

Work and Heat: Mechanics, definition of work and its limitations. Thermodynamic definition of work; examples, sign convention. Displacement work; as a part of a system boundary, as a whole of a system boundary, expressions for displacement work in various processes through p-v diagrams. Shaft work; Electrical work. Other types of work. Heat; definition, units and sign convention. Problems.

First Law of Thermodynamics: Joules experiments, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law to non - cyclic processes, energy, energy as a property, modes of energy, Extension of the First law to control volume; steady flow energy equation(SFEE), important

Module-3

Second Law of Thermodynamics: Limitations of first law of thermodynamics, Thermal reservoir, heat engine and heat pump: Schematic representation, efficiency and COP. Reversed heat engine, schematic representation, importance and superiority of a reversible heat engine and irreversible processes, internal and external reversibility. Kelvin - Planck statement of the Second law of Thermodynamics; PMM I and PMM II, Clausius statement of Second law of Thermodynamics, Equivalence of the two statements; Carnot cycle, Carnot principles. Problems

Entropy: Clausius inequality, Statement- proof, Entropy- definition, a property, change of entropy, entropy as a quantitative test for irreversibility, principle of increase in entropy, entropy as a coordinate.

Module-4

Availability, Irreversibility and General Thermodynamic relations. Introduction**,** Availability (Exergy), Unavailable energy, Relation between increase in unavailable energy and increase in entropy. Maximum work, maximum useful work for a system and control volume, irreversibility.

Pure Substances: P-T and P-V diagrams, triple point and critical points. Sub-cooled liquid, saturated liquid, mixture of saturated liquid and vapor, saturated vapor and superheated vapor states of pure substance with water as example. Enthalpy of change of phase (Latent heat). Dryness fraction (quality), T-S and H-S diagrams, representation of various processes on these diagrams. Steam tables and its use. Throttling calorimeter, separating and throttling calorimeter.

Module-5

Ideal gases: Ideal gas mixtures, Daltons law of partial pressures, Amagat's law of additive volumes, evaluation of properties of perfect and ideal gases, Air- Water mixtures and related properties.
Real gases – Introduction, Van-der Waal's Equation of state, Van-der Waal's constants in terms of critical properties, Beattie-Bridgeman equation, Law of corresponding states, compressibility factor; compressibility chart. Difference between Ideal and real gases.

Course Outcomes: At the end of the course, the student will be able to:

- CO1: Explain fundamentals of thermodynamics and evaluate energy interactions across the boundary of thermodynamic systems.
- CO2: Evaluate the feasibility of cyclic and non-cyclic processes using 2nd law of thermodynamics.
- CO3: Apply the knowledge of entropy, reversibility and irreversibility to solve numerical problems and apply 1st law of thermodynamics to closed and open systems and determine quantity of energy transfers and change in properties.
- CO4: Interpret the behavior of pure substances and its application in practical problems.
- CO5: Recognize differences between ideal and real gases and evaluate thermodynamic properties of ideal and real gas mixtures using various relations.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Basic and Applied Thermodynamics	P.K.Nag,	Tata McGraw Hill	2nd Ed., 2002
2	Basic Engineering Thermodynamics	A.Venkatesh	Universities Press,	2008
3	Basic Thermodynamics,	B.K Venkanna, Swati B. Wadavadagi	PHI, New Delhi	2010
Reference Books				
3	Thermodynamics- An Engineering Approach	YunusA.Cenegal and Michael A.Boles	Tata McGraw Hill publications	2002
4	An Introduction to Thermodynamcis	Y.V.C.Rao	Wiley Eastern	1993,
5	Engineering Thermodynamics	.B.Jones and G.A.Hawkins	John Wiley and Sons.	

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B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

MATERIAL SCIENCE

Course Code	**18ME34**	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- The foundation for understanding the structure and behaviour of materials common in mechanical engineering.
- Topics to explore the mechanical properties of metals and their alloys, polymers, ceramics, smart materials and composites.
- To understand modifications of material properties by heat treatment processes.
- Selections of different materials for various applications are highlighted.
- Impart knowledge of various failure modes of materials.

Module-1

Introduction to Crystal Structure: Coordination number, atomic packing factor, Simple Cubic, BCC,FCC and HCP Structures, Crystal imperfections–point, line, surface and volume imperfections. Atomic Diffusion: Phenomen on, Fick's laws of diffusion (First and Second Law);Factors affecting diffusion.

Mechanical Behaviour: Stress-strain diagrams showing ductile and brittle behaviour of materials, Engineering stress and true strains, Linear and non- linear elastic behaviour and properties, Mechanical properties in plastic range: Stiffness, Yield strength, Offset Yield strength, Ductility, Ultimate Tensile strength, Toughness. Plastic deformation of single crystal by slip and twinning, Mechanisms of strengthening in metals.

Module-2

Failure of Materials Fracture: Type I, Type II and Type III,

Fatigue: Types of fatigue loading with examples, Mechanism of fatigue, fatigue properties, S-N diagram, fatigue testing.

Creep: Description of the phenomenon with examples, three stages of creep, creep properties, Stress relaxation. Concept of fracture toughness, numerical on diffusion, strain and stress relaxation. Alloys, Steels, Solidification:

Conceptofformationofalloys:Typesofalloys,solidsolutions,factorsaffectingsolidsolubility(HumeRotheryrules) ,Binary phasediagrams:Eutectic,andEutectoidsystems,Leverrule,Intermediatephases,(The same type of process will study in Iron Carbon Phase Diagrams) Gibbs phase rule, Effect of non-equilibrium cooling, Coring and Homo genization Iron-Carbon (Cementite) diagram: description of phases, Effect of common alloying elements in steel, Common alloy steels, Stainless steel, Tool steel, Specifications of steels.

Solidification: Mechanism of solidification, Homogenous and Heterogeneous nucleation, Crystal growth,

Module-3

Heat Treatment, Ferrous and Non-Ferrous Alloys: Heat treating of metals: Time-Temperature-Transformation (TTT) curves, Continuous Cooling Transformation (CCT) curves, Annealing: Recovery, Re crystallization and Grain growth, Types of annealing, Normalizing, Hardening, Tempering, Mar tempering, Austempering, Concept of harden ability, Factors affecting harden ability.

Surface hardening methods: carburizing, cyaniding, nit riding, flame hardening and induction hardening, Age hardening of aluminium-copper alloys and PH steels. Ferrous materials: Properties, Compositions and uses of Grey cast iron and steel.

Module-4

Composite Materials : Composite materials - Definition, classification, types of matrix materials & reinforcements, Metal Matrix Composites (MMCs), Ceramic Matrix Composites (CMCs) and Polymer Matrix Composites (PMCs), Particulate-reinforced and fiber- reinforced composites, Fundamentals of production of composites, characterization of composites, constitutive relations of composites, determination of composite properties from component properties, hybrid composites. Applications of composite materials. Numerical on determining properties of composites.

Module-5

Other Materials, Material Selection

Ceramics: Structure type sand properties and applications of ceramics. Mechanical/ Electrical behaviour and processing of Ceramics.
Plastics: Various types of polymers/plastics and their applications. Mechanical behaviour and processing of plastics, Failure of plastics.
Other materials: Brief description of other materials such as optical and thermal materials.
Smart materials–fiber optic materials,piezo-electrics,shapememoryalloys–Nitinol,superelasticity.
Biological applications of smart materials-materials usedasim plants in human Body, selection of materials, performance of materials in service. Residual life assessment–use of non-destructive testing, economics, environment and Sustainability.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand the mechanical properties of metals and their alloys.

CO2: Analyze the various modes of failure and understand the microstructures of ferrous and non-ferrous materials.

CO3: Describe the processes of heat treatment of various alloys.

CO4: Acquire the Knowledge of composite materials and their production process as well as applications.

CO5: Understand the properties and potentialities of various materials available and material selection procedures.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Foundations of Materials Science and Engineering	Smith	McGrawHill	4thEdition, 2009.
2	Material science and Engineering and Introduction	WilliamD.Callister	Wiley	2006
3	Materials Science	Shackle ford., & M. K. Muralidhara	Pearson Publication	2007
Reference Books				
3	Materials Science and Engineering	V.Raghavan	PHI	2002
4	The Science and Engineering of Materials	Donald R. Askland and Pradeep.P. Phule	Cengage Learning	4lhEd., 2003
5	Mechanical Metallurgy	GeorgeEllwoodDieter	McGraw-Hill.	
6	ASM Handbooks	American Society of Metals		
7	Elements of Materials Science and Engineering	H. VanVlack,	Addison-Wesley Edn	1998
8	An introduction to Metallurgy	Alan Cottrell	University Press India	1974.

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B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

METAL CUTTING AND FORMING

Course Code	**18ME35A/45A**	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To enrich the knowledge pertaining to relative motion and mechanics required for various machine tools.
- To introduce students to different machine tools to produce components having different shapes and sizes.
- To develop the knowledge on mechanics of machining process and effect of various parameters on machining.
- To acquaint with the basic knowledge on fundamentals of metal forming processes
- To study various metal forming processes.

Module-1

Introduction to Metal cutting: Orthogonal and oblique cutting. Classification of cutting tools: single, and multipoint; tool signature for single point cutting tool. Mechanics of orthogonal cutting; chip formation, shear angle and its significance, Merchant circle diagram. Numerical problems.
Cutting tool materials and applications.
Introduction to basic metal cutting machine tools: Lathe- Parts of lathe machine, accessories of lathe machine, and various operations carried out on lathe. Kinematics of lathe. Turret and Capstan lathe.

Module-2

Milling: Various Milling operations, classification of milling machines, Vertical & Horizontal milling, up milling & down milling. Indexing: need of indexing, simple, compound & differential indexing.
Drilling: Difference between drilling, boring & reaming, types of drilling machines. Boring operations & boring machines.
Shaping, Planing and Slotting machines-machining operations and operating parameters.
Grinding: Grinding operation, classification of grinding processes: cylindrical, surface &centerless grinding

Module-3

Introduction to tool wear, tool wear mechanisms, tool life equations, effect of process parameters on tool life, machinability. Cutting fluid-types and applications, surface finish, effect of machining parameters on surface finish. Economics of machining process, choice of cutting speed and feed, tool life for minimum cost and production time. Numerical problems.

Module-4

MECHANICAL WORKING OF METALS
Introduction to metal forming processes & classification of metal forming processes. Hot working & cold working of metals. Forging: Smith forging, drop forging & press forging. Forging Equipment, Defects in forging.
Rolling: Rolling process, Angle of bite, Types of rolling mills, Variables of rolling process, Rolling defects.
Drawing & Extrusion: Drawing of wires, rods & pipes, Variables of drawing process. Difference between drawing & extrusion. Various types of extrusion processes.

Module-5

Sheet Metal Operations: Blanking, piercing, punching, drawing, draw ratio, drawing force, variables in drawing, Trimming, and Shearing.
Bending — types of bending dies, Bending force calculation,
Embossing and coining.
Types of dies: Progressive, compound and combination dies.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Explain the construction & specification of various machine tools.

CO2: Discuss different cutting tool materials, tool nomenclature & surface finish.

CO3: Apply mechanics of machining process to evaluate machining time.

CO4: Analyze tool wear mechanisms and equations to enhance tool life and minimize machining cost.

CO5: Understand the concepts of different metal forming processes.

CO6: Apply the concepts of design of sheet metal dies to design different dies for simple sheet metal components.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Manufacturing Technology Vol I & II	P.N.Rao	Tata McGraw Hill Pub. Co. Ltd., New Delhi	1998
2	A textbook of Production Technology Vol I and II	Sharma, P.C.,	S. Chand & Company Ltd., New Delhi	1996
3	Manufacturing Science	Amithab Gosh &A.K.Malik	East-West press	2001
Reference Books				
3	Workshop Technology Vol. I and II	Chapman W. A. J.	Arnold Publisher New Delhi	1998
4	Elements of Manufacturing Technology Vol II,	Hajra Choudhary, S. K. and Hajra Choudhary, A. K.	Media Publishers, Bombay	1988
5	Metal Forming Handbook	Schuler	Springer Verlag Publication	
6	Metal Forming: Mechanics and Metallurgy	Hosford,WF and Caddell,R.M	Prentice Hall	1993
7	Manufacturing Engineering and Technology	Kalpakjian	Addision Wesley CongmenPvt. Ltd.	2000
8	Production Technology	HMT		

B. E. MECHANICAL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - III			
METAL CASTING AND WELDING			
Course Code	**18ME35B/45B**	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To provide adequate knowledge of quality test methods conducted on welded and cast components.
- To provide knowledge of various casting process in manufacturing.
- To provide in-depth knowledge on metallurgical aspects during solidification of metal and alloys.
- To provide detailed information about the moulding processes.
- To impart knowledge of various joining process used in manufacturing.
- To impart knowledge about behaviour of materials during welding, and the effect of process parameters in welding,

Module-1

Introduction & basic materials used in foundry:
Introduction: Definition, Classification of manufacturing processes. Metals cast in the foundry-classification, factors that determine the selection of a casting alloy.
Introduction to casting process & steps involved:
Patterns: Definition, classification, materials used for pattern, various pattern allowances and their importance.
Sand moulding: Types of base sand, requirement of base sand. Binder, Additives definition, need and types; preparation of sand moulds. Melding machines- Jolt type, squeeze type and Sand slinger.
Study of important moulding process: Green sand, core sand, dry sand, sweep mould, CO_2mould, shell mould, investment mould, plaster mould, cement bonded mould.
Cores: Definition, need, types. Method of making cores,
Concept of gating (top, bottom, parting line, horn gate) and risers (open, blind) Functions and types.

Module-2

MELTING & METAL MOLD CASTING METHODS
Melting furnaces: Classification of furnaces, Gas fired pit furnace, Resistance furnace, Coreless induction furnace, electric arc furnace, constructional features & working principle of cupola furnace.
Casting using metal moulds: Gravity die casting, pressure die casting, centrifugal casting, squeeze casting, slush casting, thixocasting, and continuous casting processes.

Module-3

SOLIDIFICATION &NON-FERROUS FOUNDRY PRACTICE
Solidification: Definition, nucleation, solidification variables. Directional solidification-need and methods. Degasification in liquid metals-sources of gas, degasification methods.
Fettling and cleaning of castings: Basic steps involved. Sand Casting defects- causes, features and remedies. Advantages & limitations of casting process
Nonferrous foundry practice: Aluminium castings - advantages, limitations, melting of Aluminium using lift-out type crucible furnace. Hardeners used, drowsing, gas absorption, fluxing and flushing, grain refining, pouring temperature. Stir casting set up, procedure, uses, advantages and limitations.

Module-4

Welding process: Definition, Principles, classification, application, advantages & limitations of welding. Arc welding: Principle, Metal arc welding (MAW), Flux Shielded Metal Arc Welding (FSMAW), Inert Gas Welding (TIG & MIG) Submerged Arc Welding (SAW) and Atomic Hydrogen Welding (AHW).
Special type of welding: Resistance welding principles, Seam welding, Butt welding, Spot welding and Projection welding. Friction welding, Explosive welding, Thermit welding, Laser welding and Electron beam welding.

Module-5

METALLURGICAL ASPECTS IN WELDING, SOLDERING, AND BRAZING

Structure of welds, Formation of different zones during welding, Heat Affected Zone (HAZ), Parameters affecting HAZ. Effect of carbon content on structure and properties of steel, Shrinkage in welds& Residual stresses. Concept of electrodes, filler rod and fluxes. Welding defects- detection, causes & remedy.

Soldering, brazing, gas welding: Soldering, Brazing, Gas Welding: Principle, oxy-Acetylene welding, oxy-hydrogen welding, air-acetylene welding, Gas cutting, powder cutting.

Inspection methods: Methods used for inspection of casting and welding. Visual, magnetic particle, fluorescent particle, ultrasonic. Radiography, eddy current, holography methods of inspection.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Describe the casting process and prepare different types of cast products.

CO2: Acquire knowledge on Pattern, Core, Gating, Riser system and to use Jolt, Squeeze, Sand Slinger Moulding machines.

CO3: Compare the Gas fired pit, Resistance, Coreless, Electrical and Cupola Metal Furnaces.

CO4: Compare the Gravity, Pressure die, Centrifugal, Squeeze, slush and Continuous Metal mold castings.

CO5: Understand the Solidification process and Casting of Non-Ferrous Metals.

CO6: Describe the Metal Arc, TIG, MIG, Submerged and Atomic Hydrogen Welding processes etc. used in manufacturing.

CO7: Describe methods for the quality assurance of components made of casting and joining process

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Principles of metal casting	Rechard W. Heine, Carl R. Loper Jr., Philip C. Rosenthal	Tata McGraw Hill Education Private Limited	1976
2	Manufacturing Process-I	Dr.K.Radhakrishna	Sapna Book House,	5th Revised Edition 2009.
3	Manufacturing Technology-Foundry, Forming and	P.N.Rao	Tata McGraw Hill	3rd Ed., 2003.
Reference Books				
4	Process and Materials of Manufacturing	Roy A Lindberg	Pearson Edu	4th Ed. 2006
5	Manufacturing Technology	Serope Kalpakjian Steuen. R Sechmid	Pearson Education Asia	5th Ed. 2006

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B. E. MECHANICAL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - III			
COMPUTER AIDED MACHINE DRAWING			
Course Code	**18ME36A/46A**	CIE Marks	40
Teaching Hours/Week (L:T:P)	1:4:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To acquire the knowledge of CAD software and its features.
- To familiarize the students with Indian Standards on drawing practices.
- To impart knowledge of thread forms, fasteners, keys, joints and couplings.
- To make the students understand and interpret drawings of machine components leading to preparation of assembly drawings manually and using CAD packages.
- To acquire the knowledge of limits, tolerance and fits and indicate them on machine drawings.

Part A

Part A

Introduction:
Review of graphic interface of the software. Review of basic sketching commands and navigational commands. Starting a new drawing sheet. Sheet sizes. Naming a drawing, Drawing units, grid and snap. Conversion of pictorial views into orthographic projections of simple machine parts (with and without section). Hidden line conventions. Precedence of lines.
Sections of Solids: Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on axis inclinations, spheres and hollow solids). True shape of sections.
Conversion of pictorial views into orthographic projections of simple machine parts. Hidden line conventions. Precedence of lines.
Conversion of pictorial views into orthographic projections of simple machine parts (with section planes indicated on the part).
Thread Forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External), BSW (Internal & External) square and Acme. Sellers thread, American Standard thread.
Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw.

Part B

Keys: Parallel key, Taper key, Feather key, Gib-head key and Woodruff key.
Joints: Cotter joint (socket and spigot), knuckle joint (pin joint) for two rods.
Couplings: Split Muff coupling, Protected type flanged coupling, pin (bush) type flexible coupling, and universal coupling (Hooks' Joint)

Part C

Limits, Fits and Tolerances: Introduction, Fundamental tolerances, Deviations, Methods of placing limit dimensions, machining symbols, types of fits with symbols and applications, geometrical tolerances on drawings. Standards followed in industry.
Assembly Drawings: (Part drawings shall be given)
1. Plummer block (Pedestal Bearing)
2. Lever Safety Valve
3. I.C. Engine connecting rod
4. Screw jack (Bottle type)
5. Tailstock of lathe
6. Machine vice
7. Tool head of shaper

Course Outcomes: At the end of the course, the student will be able to:

CO1: Identify the national and international standards pertaining to machine drawing.

CO2: Understand the importance of the linking functional and visualization aspects in the preparation of the part drawings

CO3: Apply limits and tolerances to assemblies and choose appropriate fits for given assemblies.

CO4: Interpret the Machining and surface finish symbols on the component drawings.

CO5: Preparation of the part or assembly drawings as per the conventions.

Scheme of Examination: Two questions to be set from each Part A, part B and Part C. Student has to answer one question each from Part A and Part B for 25 marks each and one question from Part C for 50 marks.

INSTRUCTION FOR COMPUTER AIDED MACHINE DRAWING (15ME36A/46A) EXAMINATION

1. No restriction of timing for sketching/ computerization of solutions. The total duration is 3 hours.
2. It is desirable to do sketching of all the solutions before computerization.
3. Drawing instruments may be used for sketching.
4. For Part A and Part B, 2D drafting environment should be used.
5. For Part C, 3D environment should be used for parts and assembly, and extract 2D views of assembly.
6. Part A and Part B

   25 Marks (15 marks for sketching and 10 marks for computer work)
7. Part C

   50 Marks (20 marks for sketching and 30 marks for computer modelling)

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Machine Drawing	K.R. Gopala Krishna	Subhash Publication	2005
2	Machine Drawing	N.D.Bhat&V.M. Panchal	Charoratar publishing house	2005
Reference Books				
3	A Text Book of Computer Aided Machine Drawing	S. Trymbaka Murthy	CBS Publishers, New Delhi	2007
4	Engineering drawing	P.S.Gill	S K Kataria and Sons	2013
5	Machine Drawing	N. Siddeshwar, P. Kanniah, V.V.S. Sastri	Tata McGraw Hill	2006

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B. E. MECHANICAL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - III			
MECHANICAL MEASUREMENTS AND METROLOGY			
Course Code	**18ME36B/46B**	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To understand the concept of metrology and standards of measurement.
- To equip with knowledge of limits, fits, tolerances and gauging
- To acquire knowledge of linear and Angular measurements, Screw thread and gear measurement & comparators.
- To understand the knowledge of measurement systems and methods with emphasis on different Transducers, intermediate modifying and terminating devices.
- To understand the measurement of Force, Torque, Pressure, Temperature and Strain.

Module-1

Introduction to Metrology: Definition, objectives of metrology, Material Standards, Wavelength Standards, Classification of standards, Line and End standards, Calibration of End bars. Numerical examples.

Liner measurement and angular measurements: Slip gauges-Indian standards on slip gauges, Adjustable slip gauges, Wringing of slip gauges, Problems on building of slip gauges (M87, M112), Measurement of angle-sine bar, Sine centre, Angle gauges, Optical instruments for angular measurements. Autocollimator-Applications for measuring straightness and squareness.

Module-2

System of Limits, Fits, Tolerance and Gauging: Definitions, Tolerance, Tolerance analysis (addition & subtraction of tolerances) Inter changeability & Selective assembly. Class &grade of tolerance, Fits, Types of fits, Numerical on limits, fit and tolerance. Hole base system & shaft base system. Taylor's principle, Types of limit gauges, Numerical on limit gauge design.

Comparators: Functional requirements, Classification, Mechanical- Johnson Mikrokator, Sigma comparators, Dial indicator, Electrical comparators, LVDT, Pneumatic comparators- Principle of back pressure, Solex comparators, Optical comparators, Zeiss ultraoptimeter.

Module-3

Measurement of screw thread and gear: Terminology of screw threads, Measurement of major diameter, Minor diameter, Pitch, Angle and Effective diameter of screw threads by 2- wire and 3-wire methods, Best size wire. Screw thread gauges, Toolmaker's microscope.

Gear tooth Measurements: Tooth thickness measurement using constant chord method, Addendum, Comparator method and Base tangent method, Measurement of pitch, Concentricity, Run out and In volute profile. Gear roll tester for composite error.

Module-4

Measurement system and basic concepts of measurement methods: Definition, Significance of measurement, Generalized measurement system, Static characteristics- Accuracy, Precision, Calibration, Threshold, Sensitivity, Hysteresis, Repeatability, Linearity, Loading effect, Dynamic characteristics- System response, Time delay. Errors in measurement, Classification of errors.

Transducers: Transfer efficiency, Primary and Secondary transducers, Electrical transducers, Mechanical, Electronic transducers, Relative comparison of each type of transducers.

Intermediate Modifying and Terminating Devices: Mechanical systems, Inherent problems, Electrical intermediate modifying devices, Input circuitry, Ballast circuit, Electronic amplifiers. Terminating devices, Cathode ray oscilloscope, Oscillographs.

Module-5

Applied mechanical measurement: Measurement of force, Torque, Pressure, Types of Dynamometers, Absorption dynamometer, Prony brake and Rope brake dynamometer, and Power Measuring Instruments. Use of elastic members, Bridgeman gauge, McLeod gauge, Pirani gauge.

Measurement of strain and temperature: Theory of strain gauges, Types, Electrical resistance strain gauge, Preparation and mounting of Strain gauges, Gauge factor, Methods of strain measurement, temperature compensation, Resistance thermometers, Thermocouple, Law of thermocouple, Pyrometer, Optical pyrometer.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand the objectives of metrology, methods of measurement, standards of measurement & various measurement parameters.

CO2: Explain tolerance, limits of size, fits, geometric and position tolerances, gauges and their design

CO3: Understand the working principle of different types of comparators.

CO3: Describe measurement of major & minor diameter, pitch, angle and effective diameter of screw threads.

CO4: Explain measurement systems, transducers, intermediate modifying devices and terminating devices..

CO5: Describe functioning of force, torque, pressure, strain and temperature measuring devices.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Mechanical Measurements	Beckwith Marangoni and Lienhard	Pearson Education	6th Ed., 2006
2	Instrumentation, Measurement and Analysis	B C Nakra, K K Chaudhry	McGraw–Hill	4th Edition
3	Engineering Metrology	R.K. Jain	Khanna Publishers	2009
Reference Books				
1	Engineering Metrology and Measurements	Bentley	Pearson Education	
2	Theory and Design for Mechanical Measurements, III edition	Richard S Figliola, Donald E Beasley	WILEY India Publishers	
3	Engineering Metrology	Gupta I.C	Dhanpat Rai Publications	
4	Deoblin’s Measurement system,	Ernest Deoblin, Dhanesh manick	McGraw–Hill	
5	Engineering Metrologyand Measurements	N.V.Raghavendra and L. Krishnamurthy	Oxford University Press.	

B. E. MECHANICAL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER – III			
MATERIAL TESTING LAB			
Course Code	**18MEL37A/47A**	CIE Marks	40
Teaching Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To learn the concept of the preparation of samples to perform characterization such as microstructure, volume fraction of phases and grain size.
- To understand mechanical behaviour of various engineering materials by conducting standard tests.
- To learn material failure modes and the different loads causing failure.
- To learn the concepts of improving the mechanical properties of materials by different methods like heat treatment, surface treatment etc.

Sl. No.	Experiments
	PART A
1	Preparation of specimen for Metallographic examination of different engineering materials. To report microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze & composites.
2	Heat treatment: Annealing, normalizing, hardening and tempering of steel. Metallographic specimens of heat treated components to be supplied and students should report microstructures of furnace cooled, water cooled, air cooled, tempered steel. Students should be able to distinguish the phase changes in a heat treated specimen compared to untreated specimen.
3	Brinell, Rockwell and Vickers's Hardness tests on untreated and heat treated specimens.
4	To study the defects of Cast and Welded components using Non-destructive tests like: a) Ultrasonic flaw detection b) Magnetic crack detection c) Dye penetration testing.
	PART B
5	Tensile, shear and compression tests of steel, aluminum and cast iron specimens using Universal Testing Machine
6	Torsion Test on steel bar.
7	Bending Test on steel and wood specimens.
8	Izod and Charpy Tests on Mild steel and C.I Specimen.
9	To study the wear characteristics of ferrous and non-ferrous materials under different parameters.
10	Tensile, shear and compression tests of steel, aluminum and cast iron specimens using Universal Testing Machine
11	Fatigue Test (demonstration only).

Course Outcomes: At the end of the course, the student will be able to:

CO1: Acquire experimentation skills in the field of material testing.

CO2: Develop theoretical understanding of the mechanical properties of materials by performing experiments.

CO3: Apply the knowledge to analyse a material failure and determine the failure inducing agent/s.

CO4: Apply the knowledge of testing methods in related areas.

CO5: Understand how to improve structure/behaviour of materials for various industrial applications.

Conduct of Practical Examination:
1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.

Scheme of Examination:

ONE question from part -A:	30 Marks
ONE question from part -B:	50 Marks
Viva -Voice:	20 Marks
Total:	100 Marks

B. E. MECHANICAL ENGINEERING **Choice Based Credit System (CBCS) and Outcome Based Education (OBE)** **SEMESTER – III**			
MECHANICAL MEASUREMENTS AND METROLOGY LAB			
Course Code	**18MEL37B/47B**	CIE Marks	40
Teaching Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To illustrate the theoretical concepts taught in Mechanical Measurements & Metrology through experiments.
- To illustrate the use of various measuring tools & measuring techniques.
- To understand calibration techniques of various measuring devices.

Sl. No.	**Experiments**
	PART A
1	Calibration of Pressure Gauge
2	Calibration of Thermocouple
3	Calibration of LVDT
4	Calibration of Load cell
5	Determination of modulus of elasticity of a mild steel specimen using straingauges.
	PART B
6	Measurements using Optical Projector / Tool makers' Microscope.
7	Measurement of angle using Sine Centre / Sine bar / bevelprotractor
8	Measurement of alignment using Autocollimator / Rollerset
9	Measurement of cutting tool for cesusing:
10	Measurements of Screw thread parameters using two wire or three-wire methods.
11	Measurements of surface roughness using Tally Surf/Mechanical Comparator
12	Measurement of gear tooth profile using gear tooth Vernier/Gear tooth micrometer
13	Calibration of Micrometer using slip gauges
14	Measurement using Optical Flats

Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand Calibration of pressure gauge, thermocouple, LVDT, load cell, micrometre.

CO2: Apply concepts of Measurement of angle using Sine Centre/ Sine Bar/ Bevel Protractor, alignment using Autocollimator/ Roller set.

CO3: Demonstrate measurements using Optical Projector/Tool maker microscope, Optical flats.

CO4: Analyse tool forces using Lathe/Drill tool dynamometer.

CO5: Analyse Screw thread parameters using 2-Wire or 3-Wire method, gear tooth profile using gear tooth Vernier/Gear tooth micrometre

CO6: Understand the concepts of measurement of surface roughness.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.

Scheme of Examination:

ONE question from part -A: 30 Marks
ONE question from part -B: 50 Marks
Viva -Voice: 20 Marks
Total: 100 Marks

Updated on 16.04.2020/28092020

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – III

WORKSHOP AND MACHINE SHOP PRACTICE

Course Code	**18MEL38A/48A**	CIE Marks	40
Teaching Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To guide students to use fitting tools to perform fitting operations.
- To provide an insight to different machine tools, accessories and attachments.
- To train students into fitting and machining operations to enrich their practical skills.
- To inculcate team qualities and expose students to shop floor activities.
- To educate students about ethical, environmental and safety standards.

	Experiments
Sl. No	**PART A**
1	Preparation of at least two fitting joint models by proficient handling and application of hand tools- V-block, marking gauge, files, hack saw drills etc.
	PART B
2	Preparation of three models on lathe involving - Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, Drilling, Boring, Internal Thread cutting and Eccentric turning. Exercises should include selection of cutting parameters and cutting time estimation.
	PART C
3	Cutting of V Groove/ dovetail / Rectangular groove using a shaper. Cutting of Gear Teeth using Milling Machine. Exercises should include selection of cutting parameters and cutting time estimation.
	PART D (DEMONSTRATION ONLY)
	Study & Demonstration of power tools like power drill, power hacksaw, portable hand grinding, cordless screw drivers, production air tools, wood cutter, etc., used in Mechanical Engineering.

Course Outcomes: At the end of the course, the student will be able to:

CO1: To read working drawings, understand operational symbols and execute machining operations.
CO2: Prepare fitting models according to drawings using hand tools- V-block, marking gauge, files, hack saw, drills etc.
CO3: Understand integral parts of lathe, shaping and milling machines and various accessories and attachments used.
CO4: Select cutting parameters like cutting speed, feed, depth of cut, and tooling for various machining operations.
CO5: Perform cylindrical turning operations such as plain turning, taper turning, step turning, thread Cutting, facing, knurling, internal thread cutting, eccentric turning and estimate cutting time.
CO6:Perform machining operations such as plain shaping, inclined shaping, keyway cutting, Indexing and

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

Scheme of Examination:	
One Model from Part-A or Part-C:	30 Marks
One Model from Part-B:	50 Marks
Viva – Voce:	20 Marks
TOTAL:	100 Marks

B. E. MECHANICAL ENGINEERING **Choice Based Credit System (CBCS) and Outcome Based Education (OBE)** **SEMESTER – III**			
FOUNDRY, FORGING AND WELDING LAB			
Course Code	**18MEL38B/48B**	CIE Marks	40
Teaching Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To provide an insight into different sand preparation and foundry equipment.
- To provide an insight into different forging tools and equipment and arc welding tools and equipment.
- To provide training to students to enhance their practical skills in welding, forging and hand moulding.

Sl. No	**Experiments**
	PART A
1	**Testing of Molding sand and Core sand.** **Preparation of sand specimens and conduction of the following tests:** 1. Compression, Shear and Tensile tests on Universal Sand Testing Machine. 2. Permeability test 3. Sieve Analysis to find Grain Fineness Number (GFN) of Base Sand 4. Clay content determination on Base Sand. **Welding Practice:** Use of Arc welding tools and welding equipment Preparation of welded joints using Arc Welding equipment L-Joint, T-Joint, Butt joint, V-Joint, Lap joints on M.S. flats
	PART B
2	**Foundry Practice:** **Use of foundry tools and other equipment for Preparation of molding sand mixture.** **Preparation of green sand molds kept ready for pouring in the following cases:** 1. Using two molding boxes (hand cut molds). 2. Using patterns (Single piece pattern and Split pattern). 3. Incorporating core in the mold.(Core boxes). 4. Preparation of one casting (Aluminium or cast iron-Demonstration only)
	PART C
3	**Forging Operations:** Use of forging tools and other forging equipment. • Calculation of length of the raw material required to prepare the model considering scale loss. • Preparing minimum three forged models involving upsetting, drawing and bending operations.

Course Outcomes: At the end of the course, the student will be able to:

- Demonstrate various skills in preparation of molding sand for conducting tensile, shear and compression tests using Universal sand testing machine.
- Demonstrate skills in determining permeability, clay content and Grain Fineness Number of base sands.
- Demonstrate skills in preparation of forging models involving upsetting, drawing and bending operations.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

Scheme of Examination:

1. One question is to be set from Part-A : 30 marks
   (20 marks for sand testing+ 10 Marks for welding)
2. One question is to be set from either Part-B or Part-C: 50 Marks
3. Viva – Voce: 20 marks

ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ
ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯಪುಸ್ತಕ

(ಕನ್ನಡ ಮಾತೃಭಾಷೆಯ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ)

(ಕನ್ನಡಿಗರಿಗಾಗಿ – **for Kannadigas -** Common to all branches)

[As per Outcome Based Education (OBE) and Choice Based Credit System (CBCS) scheme]

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

- ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡದ ಜೊತೆಗೆ ಕ್ರಿಯಾತ್ಮಕ ಕನ್ನಡವನ್ನು, ಕನ್ನಡ ಸಾಹಿತ್ಯ, ಸಂಸ್ಕೃತಿ ಮತ್ತು ನಾಡು ನುಡಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
- ಕನ್ನಡದಲ್ಲಿ ತಾಂತ್ರಿಕ ವಿಜ್ಞಾನಗಳ ವಿಷಯಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ಹಲವಾರು ವಿಷಯಗಳನ್ನು ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
- ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ, ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.

ಪರಿವಿಡಿ

ಭಾಗ – ಒಂದು ಲೇಖನಗಳು

ಕನ್ನಡ ನಾಡು, ನುಡಿ ಮತ್ತು ಸಂಸ್ಕೃತಿಗೆ ಸಂಬಂಧಿಸಿದ ಲೇಖನಗಳು

೧. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ : ಹಂಪ ನಾಗರಾಜಯ್ಯ
೨. ಕರ್ನಾಟಕದ ಏಕೀಕರಣ : ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ – ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ
೩. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ – ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ ಮತ್ತು ಪ್ರೊ. ವಿ. ಕೇಶವಮೂರ್ತಿ *

ಭಾಗ – ಎರಡು

ಕಾವ್ಯ ಭಾಗ (ಆಧುನಿಕ ಪೂರ್ವ)

೪. ವಚನಗಳು : ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಆಯ್ದಕ್ಕಿ ಮಾರಯ್ಯ, ಜೇಡರ ದಾಸಿಮಯ್ಯ, ಆಯ್ದಕ್ಕಿ ಲಕ್ಕಮ್ಮ.
೫. ಕೀರ್ತನೆಗಳು : ಅದರಿಂದೇನು ಫಲ ಇದರಿಂದೇನು ಫಲ – ಪುರಂದರದಾಸ
ತಲ್ಲಣಿಸದಿರು ಕಂಡ್ಯ ತಾಳು ಮನವೆ – ಕನಕದಾಸ
೬. ತತ್ವಪದಗಳು : ಸಾವಿರ ಕೊಡಗಳ ಸುಟ್ಟು – ಶಿಶುನಾಳ ಷರೀಫ
ಶಿವಯೋಗಿ – ಬಾಲಲೀಲಾ ಮಹಾಂತ ಶಿವಯೋಗಿ
೭. ಜನಪದ ಗೀತೆ : ಬೀಸುವ ಪದ, ಬಡವರಿಗೆ ಸಾವ ಕೊಡಬೇಡ

ಭಾಗ – ಮೂರು

ಕಾವ್ಯ ಭಾಗ (ಆಧುನಿಕ)

೮. ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗ : ಡಿ.ವಿ.ಜಿ.

೯. ಕುರುಡು ಕಾಂಚಾಣಾ : ದ.ರಾ. ಬೇಂದ್ರೆ
೧೦. ಹೊಸಬಾಳಿನ ಗೀತೆ : ಕುವೆಂಪು
೧೧. ಹೆಂಡತಿಯ ಕಾಗದ : ಕೆ.ಎಸ್. ನರಸಿಂಹಸ್ವಾಮಿ
೧೨. ಮಬ್ಬಿನಿಂದ ಮಬ್ಬಿಗೆ : ಜಿ.ಎಸ್. ಶಿವರುದ್ರಪ್ಪ
೧೩. ಆ ಮರ ಈ ಮರ : ಚಂದ್ರಶೇಖರ ಕಂಬಾರ
೧೪. ಚೋಮನ ಮಕ್ಕಳ ಹಾಡು : ಸಿದ್ಧಲಿಂಗಯ್ಯ

ಭಾಗ – ನಾಲ್ಕು

ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿ ಪರಿಚಯ, ಕಥೆ ಮತ್ತು ಪ್ರವಾಸ ಕಥನ

೧೫. ಡಾ. ಸರ್ ಎಂ ವಿಶ್ವೇಶ್ವರಯ್ಯ – ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ : ಎ ಎನ್ ಮೂರ್ತಿರಾವ್
೧೬. ಯುಗಾದಿ : ವಸುಧೇಂದ್ರ
೧೭. ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ : ಹಿ.ಚಿ. ಬೋರಲಿಂಗಯ್ಯ

ಭಾಗ – ಐದು

ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ

೧೮. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ : ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ
೧೯. 'ಕ' ಮತ್ತು 'ಬ' ಬರಹ ತಂತ್ರಾಂಶಗಳು ಮತ್ತು ಕನ್ನಡದ ಟೈಪಿಂಗ್*
೨೦. ಕನ್ನಡ – ಕಂಪ್ಯೂಟರ್ ಶಬ್ದಕೋಶ*
೨೧. ತಾಂತ್ರಿಕ ಪದಕೋಶ : ತಾಂತ್ರಿಕ ಹಾಗೂ ಪಾರಿಭಾಷಿಕ ಕನ್ನಡ ಪದಗಳು*

* (**ಅಧ್ಯಾಯ 3, 19, 20 ಮತ್ತು 21 ಇವುಗಳು** ವಿತಾವಿ ಯದಿಂದ ಪ್ರಕಟಿತ **" ಆಡಳಿತ ಕನ್ನಡ "** ಪುಸ್ತಕದಿಂದ ಆಯ್ದ ಲೇಖನಗಳು **– ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ** ಮತ್ತು **ಪ್ರೊ. ವಿ. ಕೇಶವಮೂರ್ತಿ.**

ಸಂಪಾದಕರು

ಡಾ. ಹಿ. ಚಿ. ಬೋರಲಿಂಗಯ್ಯ
ವಿಶ್ರಾಂತ ಕುಲಪತಿಗಳು, ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ.

ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ
ಸಹಾಯಕ ಪ್ರಾಧ್ಯಾಪಕರು ಮತ್ತು ಮುಖ್ಯಸ್ಥರು,
ಮಾನವಿಕ ಮತ್ತು ಸಾಮಾಜಿಕ ವಿಜ್ಞಾನಗಳ ವಿಭಾಗ,
ಸರ್ಕಾರಿ ಇಂಜಿನಿಯರಿಂಗ್ ಕಾಲೇಜು, ಹಾಸನ.

ಪ್ರಕಟಣೆ

ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

2020

ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ

ಕನ್ನಡೇತರರಿಗೆ ಕನ್ನಡ ಕಲಿಸಲು ಗೊತ್ತುಪಡಿಸಿದ ಪಠ್ಯಪುಸ್ತಕ

ಬಳಕೆ ಕನ್ನಡ - baLake Kannada (Kannada for Usage)

(Common to B.Arch, B.Plan and B.E/B.Tech of all branches)

[As per Outcome Based Education (OBE) and Choice Based Credit System (CBCS) scheme]

Course Learning Objectives:

The course will enable the non Kannadiga students to understand, speak, read and write Kannada language and communicate (converse) in Kannada language in their daily life with kannada speakers.

Table of Contents

Introduction to the Book,
Necessity of learning a local langauge:
Tips to learn the language with easy methods.
Easy learning of a Kannada Language: A few tips
Hints for correct and polite conservation
Instructions to Teachers for Listening and Speaking Activities
Key to Transcription
Instructions to Teachers

Part – I Lessons to teach and Learn Kannada Language

Lesson – 1 ವೈಯಕ್ತಿಕ, ಸ್ವಾಮ್ಯಸೂಚಕ/ಸಂಬಂಧಿತ ಸಾರ್ವನಾಮಗಳು ಮತ್ತು ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು - **Personal Pronouns, Possessive Forms, Interrogative words**

Lesson – 2 ನಾಮಪದಗಳ ಸಂಬಂಧಾರ್ಥಕ ರೂಪಗಳು, ಸಂದೇಹಾಸ್ಪದ ಪ್ರಶ್ನೆಗಳು ಮತ್ತು ಸಂಬಂಧವಾಚಕ ನಾಮಪದಗಳು - **Possessive forms of nouns, dubitive question and Relative nouns**

Lesson – 3 ಗುಣ, ಪರಿಮಾಣ ಮತ್ತು ವರ್ಣಬಣ್ಣ ವಿಶೇಷಣಗಳು, ಸಂಖ್ಯಾವಾಚಕಗಳು **Qualitative, Quantitative and Colour Adjectives, Numerals**

Lesson – 4 ಕಾರಕ ರೂಪಗಳು ಮತ್ತು ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು – ಸಪ್ತಮಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯ – (ಆ, ಅದು, ಅವು, ಅಲ್ಲಿ) **Predictive Forms, Locative Case**

Lesson – 5 ಚತುರ್ಥಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯದ ಬಳಕೆ ಮತ್ತು ಸಂಖ್ಯಾವಾಚಕಗಳು – **Dative Cases, and Numerals**

Lesson – 6 ಸಂಖ್ಯಾಗುಣವಾಚಕಗಳು ಮತ್ತು ಬಹುವಚನ ನಾಮರೂಪಗಳು - **Ordinal numerals and Plural markers**

Lesson – 7 ನ್ಯೂನ / ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾಪದಗಳು ಮತ್ತು ವರ್ಣ ಗುಣವಾಚಕಗಳು **Defective / Negative Verbs and Colour Adjectives**

Lesson – 8 ಅಪ್ಪಣೆ / ಒಪ್ಪಿಗೆ, ನಿರ್ದೇಶನ, ಪ್ರೋತ್ಸಾಹ ಮತು ಒತ್ತಾಯ ಆರ್ಥರೂಪ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು - **Permission, Commands, encouraging**

and Urging words (Imperative words and sentences)

Lesson – 9 **ಸಾಮಾನ್ಯ ಸಂಭಾಷಣೆಗಳಲ್ಲಿ ದ್ವಿತೀಯ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ಸಂಭವನೀಯ ಪ್ರಕಾರಗಳು**
Accusative Cases and Potential Forms used in General Communication

Lesson – 10 **"ಇರು ಮತ್ತು ಇರಲ್ಲ" ಸಹಾಯಕ ಕ್ರಿಯಾಪದಗಳು, ಸಂಭಾವ್ಯಸೂಚಕ ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾ ಪದಗಳು**
Helping Verbs "iru and iralla", Corresponding Future and Negation Verbs

Lesson – 11 **ಹೋಲಿಕೆ (ತರತಮ) , ಸಂಬಂಧ ಸೂಚಕ ಮತ್ತು ವಸ್ತು ಸೂಚಕ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಪದಗಳ ಬಳಕೆ**
Comparitive, Relationship, Identification and Negation Words

Lesson – 12 **ಕಾಲ ಮತ್ತು ಸಮಯದ ಹಾಗೂ ಕ್ರಿಯಾಪದಗಳ ವಿವಿಧ ಪ್ರಕಾರಗಳು**
Different types of forms of **Tense, Time and Verbs**

Lesson – 13 **ದ್, -ತ್, - ತು, - ಇತು, - ಆಗಿ, - ಅಲ್ಲ, - ಗ್, -ಕ್, ಇದೆ, ಕ್ರಿಯಾ ಪ್ರತ್ಯಯಗಳೊಂದಿಗೆ ಭೂತ, ಭವಿಷ್ಯತ್ ಮತ್ತು ವರ್ತಮಾನ ಕಾಲ ವಾಕ್ಯ ರಚನೆ**
Formation of Past, Future and Present Tense Sentences with Verb Forms

Lesson – 14 **ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮತ್ತು ರಾಜ್ಯದ ಬಗ್ಗೆ ಕುರಿತಾದ ಇತರೆ ಮಾಹಿತಿಗಳು**
Karnataka State and General Information about the State

Lesson – 15 **ಕನ್ನಡ ಭಾಷೆ ಮತ್ತು ಸಾಹಿತ್ಯ -**
Kannada Language and Literature

Lesson – 16 **ಭಾಷೆ ಕಲಿಯಲು ಏನನ್ನುಮಾಡಬೇಕು ಮತ್ತು ಮಾಡಬಾರದು**
Do's and Don'ts in Learning a Language

Lesson – 17 **PART - II**
Kannada Language Script Part – 1

Lesson – 18 **PART - III**
Kannada Vocabulary List : ಸಂಭಾಷಣೆಯಲ್ಲಿ ದಿನೋಪಯೋಗಿ ಕನ್ನಡ ಪದಗಳು - Kannada Words in Conversation

ಲೇಖಕರು

ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ
ಸಹಾಯಕ ಪ್ರಾಧ್ಯಾಪಕರು ಮತ್ತು ಮುಖ್ಯಸ್ಥರು
ಮಾನವಿಕ ಮತ್ತು ಸಾಮಾಜಿಕ ವಿಜ್ಞಾನಗಳ ವಿಭಾಗ
ಸರ್ಕಾರಿ ಇಂಜಿನಿಯರಿಂಗ್ ಕಾಲೇಜು - ಹಾಸನ

ಪ್ರಕಟಣೆ
ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.
2020

B. E. MECHANICAL ENGINEERING Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER - III			
CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND CYBER LAW (CPC)			
Course Code	**18CPC39/49**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(1:0:0)	SEE Marks	60
Credits	01	Exam Hours	02

Course Learning Objectives: To

- know the fundamental political codes, structure, procedures, powers, and duties of Indian government institutions, fundamental rights, directive principles, and the duties of citizens
- Understand engineering ethics and their responsibilities; identify their individual roles and ethical responsibilities towards society.
- Know about the cybercrimes and cyber laws for cyber safety measures.

Module-1

Introduction to Indian Constitution: The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian constitution, The Making of the Constitution, The Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India. Fundamental Rights and its Restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and significance in Nation building.

Module-2

Union Executive and State Executive: Parliamentary System, Federal System, Centre-State Relations. Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism. State Executives – Governor, Chief Minister, State Cabinet, State Legislature, High Court and Subordinate Courts, Special Provisions (Articles 370.371,371J) for some States.

Module-3

Elections, Amendments and Emergency Provisions: Elections, Electoral Process, and Election Commission of India, Election Laws. Amendments - Methods in Constitutional Amendments (How and Why) and Important Constitutional Amendments. Amendments – 7,9,10,12,42,44, 61, 73,74, ,75, 86, and 91,94,95,100,101,118 and some important Case Studies. Emergency Provisions, types of Emergencies and its consequences.

Constitutional special provisions: Special Provisions for SC and ST, OBC, Women, Children and Backward Classes.

Module-4

Professional / Engineering Ethics: Scope & Aims of Engineering & Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Engineering and Professionalism, Positive and Negative Faces of Engineering Ethics, Code of Ethics as defined in the website of Institution of Engineers (India): Profession, Professionalism, and Professional Responsibility. Clash of Ethics, Conflicts of Interest. Responsibilities in Engineering Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. Trust and Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering

Module-5

Internet Laws, Cyber Crimes and Cyber Laws: Internet and Need for Cyber Laws, Modes of Regulation of Internet, Types of cyber terror capability, Net neutrality, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000, Internet Censorship. Cybercrimes and enforcement agencies.

Course Outcomes: On completion of this course, students will be able to,

- CO1: Have constitutional knowledge and legal literacy.
- CO2: Understand Engineering and Professional ethics and responsibilities of Engineers.
- CO3: Understand the the cybercrimes and cyber laws for cyber safety measures.

Question paper pattern for SEE and CIE:

- The SEE question paper will be set for 100 marks and the marks scored by the students will proportionately be reduced to 60. The pattern of the question paper will be objective type (MCQ).
- For the award of 40 CIE marks, refer the University regulations 2018.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Constitution of India, Professional Ethics and Human Rights	Shubham Singles, Charles E. Haries, and et al	Cengage Learning India	2018
2	Cyber Security and Cyber Laws	Alfred Basta and et al	Cengage Learning India	2018
Reference Books				
3	Introduction to the Constitution of India	Durga Das Basu	Prentice –Hall,	2008.
4	Engineering Ethics	M. Govindarajan, S. Natarajan, V. S. Senthilkumar	Prentice –Hall,	2004

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B. E. MECHANICAL ENGINEERING
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER - III

ADDITIONAL MATHEMATICS – I
(Mandatory Learning Course: Common to All Programmes)
(A Bridge course for Lateral Entry students under Diploma quota to BE/B. Tech. programmes)

Course Code	**18MATDIP31**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:1:0)	SEE Marks	60
Credits	0	Exam Hours	03

Course Learning Objectives:
- To provide basic concepts of complex trigonometry, vector algebra, differential and integral calculus.
- To provide an insight into vector differentiation and first order ODE's.

Module-1

Complex Trigonometry: Complex Numbers: Definitions and properties. Modulus and amplitude of a complex number, Argand's diagram, De-Moivre's theorem (without proof).
Vector Algebra: Scalar and vectors. Addition and subtraction and multiplication of vectors- Dot and Cross products, problems.

Module-2

Differential Calculus: Review of elementary differential calculus. Polar curves –angle between the radius vector and the tangent pedal equation- Problems. Maclaurin's series expansions, problems.
Partial Differentiation: Euler's theorem for homogeneous functions of two variables. Total derivatives - differentiation of composite function. Application to Jacobians of order two.

Module-3

Vector Differentiation: Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and vector point functions. Gradient, Divergence, Curl and Laplacian (Definitions only). Solenoidal and irrotational vector fields-Problems.

Module-4

Integral Calculus: Review of elementary integral calculus. Statement of reduction formulae for $\sin^n x, \cos^n x, and \sin^m x \times \cos^n x$and evaluation of these with standard limits-Examples. Double and triple integrals, problems.

Module-5

Ordinary differential equations (ODE's): Introduction-solutions of first order and first degree differential equations: Variable Separable methods, exact and linear differential equations of order one. Application to Newton's law of cooling.

Course Outcomes: At the end of the course the student will be able to:
- CO1: Apply concepts of complex numbers and vector algebra to analyze the problems arising in related area.
- CO2: Use derivatives and partial derivatives to calculate rate of change of multivariate functions.
- CO3: Analyze position, velocity and acceleration in two and three dimensions of vector valued functions. CO4: Learn techniques of integration including the evaluation of double and triple integrals.
- CO5: Identify and solve first order ordinary differential equations.

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook				
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	43rd Edition, 2015

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Reference Books				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10^{th} Edition, 2015
2	Engineering Mathematics Vol.I	RohitKhurana	Cengage Learning	2015

B. E. MECHANICAL ENGINEERING **Outcome Based Education (OBE) and Choice Based Credit System (CBCS)** **SEMESTER - IV**			
COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS (Common to all programmes) [As per Choice Based Credit System (CBCS) scheme]			
Course Code	**18MAT41**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To provide an insight into applications of complex variables, conformal mapping and special functions arising in potential theory, quantum mechanics, heat conduction and field theory.
- To develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in digital signal processing, design engineering and microwave engineering.

Module-1

Calculus of complex functions: Review of function of a complex variable, limits, continuity, and differentiability. Analytic functions: Cauchy-Riemann equations in Cartesian and polar forms and consequences.

Construction of analytic functions: Milne-Thomson method-Problems.

Module-2

Conformal transformations: Introduction. Discussion of transformations:$w = Z^2, w = e^z, w = z + \frac{1}{z}, (z \neq 0)$.Bilinear transformations- Problems.

Complex integration: Line integral of a complex function-Cauchy's theorem and Cauchy's integral formula and problems.

Module-3

Probability Distributions: Review of basic probability theory. Random variables (discrete and continuous), probability mass/density functions. Binomial, Poisson, exponential and normal distributions- problems (No derivation for mean and standard deviation)-Illustrative examples.

Module-4

Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation -problems. Regression analysis- lines of regression –problems.

Curve Fitting: Curve fitting by the method of least squares- fitting the curves of the form-
$y = ax + b, y = ax^b andy = ax^2 + bx + c$.

Module-5

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation and covariance.

Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.

Course Outcomes:

At the end of the course the student will be able to:

- Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory.
- Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing.
- Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.
- Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
- Construct joint probability distributions and demonstrate the validity of testing the hypothesis.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10^{th} Edition,2016
2	Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers	44^{th} Edition, 2017
3	Engineering Mathematics	Srimanta Pal et al	Oxford University Press	3^{rd} Edition,2016
Reference Books				
1	Advanced Engineering Mathematics	C. Ray Wylie, Louis C.Barrett	McGraw-Hill	6^{th} Edition 1995
2	Introductory Methods of Numerical Analysis	S.S.Sastry	Prentice Hall of India	4^{th} Edition 2010
3	Higher Engineering Mathematics	B. V. Ramana	McGraw-Hill	11^{th} Edition,2010
4	A Text Book of Engineering Mathematics	N. P. Bali and Manish Goyal	Laxmi Publications	2014

Web links and Video Lectures:

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU EDUSAT PROGRAMME - 20

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

APPLIED THERMODYNAMICS

Course Code	**18ME42**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

- To understand the applications of the first and second laws of Thermodynamics to various gas processes and cycles.
- To understand fundamentals of I. C. Engines, Construction and working Principle of an Engine and Compare Actual, Fuel-Air and Air standard cycle Performance.
- To study Combustion in SI and CI engines and its controlling factor in order to extract maximum power.
- To know the concepts of testing of I. C. Engines and methods to estimate Indicated, Brake and Frictional Power and efficiencies.
- To understand theory and performance Calculation of Positive displacement compressor.
- To understand the concepts related to Refrigeration and Air conditioning.
- To get conversant with Psychrometric Charts, Psychrometric processes, human comfort conditions.

Module-1

Air standard cycles: Carnot, Otto, Diesel, Dual and Stirling cycles, p-v and T -s diagrams, description, efficiencies and mean effective pressures. Comparison of Otto and Diesel cycles.

I.C.Engines: Classification of IC engines, Combustion of SI engine and CI engine, Detonation and factors affecting detonation, Performance analysis of I.C Engines, Heat balance, Morse test, IC Engine fuels, Ratings and Alternate Fuels.

Module-2

Gas power Cycles: Gas turbine (Brayton) cycle; description and analysis. Regenerative gas turbine cycle. Inter-cooling and reheating in gas turbine cycles. Introduction to Jet Propulsion cycles.

Module-3

Vapour Power Cycles: Carnot vapour power cycle, drawbacks as a reference cycle. Simple Rankine cycle; description, T-S diagram, analysis for performance. Comparison of Carnot and Rankine cycles. Effects of pressure and temperature on Rankine cycle performance.

Actual vapour power cycles. Ideal and practical regenerative Rankine cycles, open and closed feed water heaters. Reheat Rankine cycle. Characteristics of an Ideal working fluid in vapour power cycles.

Module-4

Refrigeration Cycles: Vapour compression refrigeration system; description, analysis, refrigerating effect. Capacity, power required units of refrigeration, COP, Refrigerants and their desirable properties, alternate Refrigerants. Air cycle refrigeration; reversed Carnot cycle, reversed Brayton cycle, vapour absorption refrigeration system.

Pscychrometrics and Air-conditioning Systems: Psychometric properties of Air, Psychometric Chart, Analyzing Air-conditioning Processes; Heating, Cooling, Dehumidification and Humidification, Evaporative Cooling. Adiabatic mixing of two moist air streams. Cooling towers.

Module-5

Reciprocating Compressors: Operation of a single stage reciprocating compressors. Work input through p-v diagram and steady state steady flow analysis. Effect of Clearance and Volumetric efficiency. Adiabatic, Isothermal and Mechanical efficiencies. Multi-stage compressor, saving in work, Optimum intermediate pressure, Inter-cooling, Minimum work for compression.

Steam nozzles: Flow of steam through nozzles, Shape of nozzles, effect of friction, Critical pressure ratio, Supersaturated flow.

Course Outcomes: At the end of the course the student will be able to:

CO1: Apply thermodynamic concepts to analyze the performance of gas power cycles.
CO2: Apply thermodynamic concepts to analyze the performance of vapour power cycles.
CO3: Understand combustion of fuels and performance of I C engines.
CO4: Understand the principles and applications of refrigeration systems.
CO5: Apply Thermodynamic concepts to determine performance parameters of refrigeration and air-conditioning systems.
CO6: Understand the working principle of Air compressors and Steam nozzles, applications, relevance of air and identify methods for performance improvement.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Engineering Thermodynamics	P.K. Nag	Tata McGraw Hill	6th Edition 2018
2	Applications of Thermodynamics	V.Kadambi, T. R.Seetharam, K. B. Subramanya Kumar	Wiley Indian Private Ltd	1st Edition 2019
3	Thermodynamics	Yunus A, Cengel, Michael A Boles	Tata McGraw Hill	7th Edition
Reference Books				
1	Thermodynamics for engineers	Kenneth A. Kroos and Merle C. Potter	Cengage Learning	2016
2	Principles of Engineering Thermodynamics	Michael J, Moran, Howard N. Shapiro	Wiley	8th Edition
3	An Introduction to Thermo Dynamics	Y.V.C.Rao	Wiley Eastern Ltd	2003.
4	Thermodynamics	Radhakrishnan	PHI	2nd revised edition
5	I.C Engines	Ganeshan.V	Tata McGraw Hill	4th Edi. 2012
6	I.C.Engines	M.L.Mathur& Sharma.	Dhanpat Rai& sons-India	

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – IV

FLUID MECHANICS

Course Code	**18ME43**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To have a working knowledge of the basic properties of fluids and understand the continuum approximation.
- To calculate the forces exerted by a fluid at rest on submerged surfaces and understand the force of buoyancy.
- To understand the flow characteristic and dynamics of flow field for various engineering applications.
- To know how velocity changes and energy transfers in fluid flows are related to forces and torques and to understand why designing for minimum loss of energy in fluid flows is so important.
- To discuss laminar and turbulent flow and appreciate their differences and the concept of boundary layer theory.
- To understand the concept of dynamic similarity and how to apply it to experimental modelling.
- To appreciate the consequences of compressibility in gas flow and understand the effects of friction and heat transfer on compressible flows.

Module-1

Basics: Introduction, Properties of fluids-mass density, weight density, specific volume, specific gravity, viscosity, surface tension, capillarity, vapour pressure, compressibility and bulk modulus. Concept of continuum, types of fluids etc., pressure at a point in the static mass of fluid, variation of pressure. Pascal’s law, absolute, gauge, atmospheric and vacuum pressures; pressure measurement by simple, differential manometers and mechanical gauges.

Fluid Statics: Total pressure and centre of pressure for horizontal plane, vertical plane surface and inclined plane surface submerged in static fluid.

Module-2

Buoyancy, center of buoyancy, meta center and meta centric height its application.

Fluid Kinematics: Velocity of fluid particle, types of fluid flow, description of flow, continuity equation, Coordinate free form, acceleration of fluid particle, rotational & irrotational flow, Laplace’s equation in velocity potential and Poisson’s equation in stream function, flow net.

Module-3

Fluid Dynamics; Introduction. Forces acting on fluid in motion. Euler’s equation of motion along a streamline. Integration of Euler’s equation to obtain Bernoulli’s equation, Assumptions and limitations of Bernoulli’s equation. Introduction to Navier-Stokes equation. Application of Bernoulli’s theorem such as venturi-meter, orifice meter, rectangular and triangular notch, pitot tube.

Laminar and turbulent flow: Flow through circular pipe, between parallel plates, Power absorbed in viscous flow in bearings, Poiseuille equation – velocity profile loss of head due to friction in viscous flow. Reynolds’s experiment, frictional loss in pipe flow. Introduction to turbulence, characteristics of turbulent flow, laminar-turbulent transition major and minor losses.

Module-4

Flow over bodies: Development of boundary layer, Prandtl‟s boundary layer equations, Blasius solution, integral momentum equation, drag on a flat plate, boundary layer separation and its control, streamlined and bluff bodies -flow around circular bodies and aero foils, calculation of lift and drag.

Dimensional analysis: Introduction, derived quantities, dimensions of physical quantities, dimensional homogeneity, Rayleigh’s method, Buckingham Pi-theorem, dimensionless numbers, similitude, types of similitude.

Module-5

Compressible Flows: Introduction, thermodynamic relations of perfect gases, internal energy and enthalpy, speed of sound, pressure field due to a moving source, basic Equations for one-dimensional flow, stagnation and sonic properties, normal and oblique shocks.

Introduction to CFD: Necessity, limitations, philosophy behind CFD, applications.

Course Outcomes: At the end of the course the student will be able to:

CO1: Identify and calculate the key fluid properties used in the analysis of fluid behavior.

CO2: Explain the principles of pressure, buoyancy and floatation

CO3: Apply the knowledge of fluid statics, kinematics and dynamics while addressing problems of mechanical and chemical engineering.

CO4: Describe the principles of fluid kinematics and dynamics.

CO5: Explain the concept of boundary layer in fluid flow and apply dimensional analysis to form dimensionless numbers in terms of input output variables.

CO6: Illustrate and explain the basic concept of compressible flow and CFD

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	A Text Book of Fluid Mechanis And Hydraulic Machines	Dr R.K Bansal	Laxmi Publishers	
2	Fluid Mechanics	F M White	McGraw Hill Publications	Eighth edition. 2016
3	Fluid Mechanics (SI Units)	Yunus A. Cengel John M.Cimbala	TataMcGraw Hill	3rd Ed.,2014.
Reference Books				
1	Fluid Mechanics	F M White	McGraw Hill Publications	Eighth edition. 2016
2	Fundamentals of Fluid Mechanics	Munson, Young, Okiishi&Huebsch,	John Wiley Publications	7th edition
3	Fluid Mechanics	Pijush.K.Kundu, IRAM COCHEN	ELSEVIER	3rd Ed. 2005
4	Fluid Mechanics	John F.Douglas, Janul and M.Gasiosek and john A.Swaffield	Pearson Education Asia	5th ed., 2006
5	Introduction to Fluid Mechanics	Fox, McDonald	John Wiley Publications	8th edition.

E- Learning

- Nptel.ac.in
- VTU, E- learning
- MOOCS
- Open courseware

B. E. MECHANICAL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER – IV			
KINEMATICS OF MACHINES			
Course Code	**18ME44**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To understand the concept of machines, mechanisms and related terminologies.
- To expose the students to various mechanisms and motion transmission elements used in Mechanical Engineering.
- To analyze a mechanism for displacement, velocity and acceleration at any point in a moving link.
- To understand the theory of cams, gears and gear trains.

Module-1

Mechanisms: Definitions: Link , types of links, joint, types of joints kinematic pairs, Constrained motion, kinematic chain, mechanism and types , degrees of freedom of planar mechanisms, Equivalent mechanisms, Groshoff's criteria and types of four bar mechanisms, , inversions of of four bar chain, slider crank chain, Doubler slider crank chain and its inversions, Grashoff's chain. Mechanisms: Quick return motion mechanisms-Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism. Straight line motion mechanisms, Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms: Geneva wheel mechanism, Ratchet and Pawl mechanism, toggle mechanism, pantograph, condition for correct steering, Ackerman steering gear mechanism.

Module-2

Velocity and Acceleration Analysis of Mechanisms (Graphical Method): Velocity and acceleration analysis of four bar mechanism, slider crank mechanism. Mechanism illustrating Corioli's component of acceleration. Angular velocity and angular acceleration of links, velocity of rubbing. Velocity Analysis by Instantaneous Center Method: Definition, Kennedy's theorem, Determination of linear and angular velocity using instantaneous center method

Module-3

Velocity and Acceleration Analysis of Mechanisms (Analytical Method): Velocity and acceleration analysis of four bar mechanism, slider crank mechanism using complex algebra method. Freudenstein's equation for four bar mechanism and slider crank mechanism. Function Generation for four bar mechanism.

Module-4

Cams: Classification of cams, Types of followers, Cam nomenclature, Follower motions and motion analysis, of SHM, Motion with uniform acceleration and deceleration, uniform velocity, cycloidal motion, Cam profile with offset knife edge follower, roller follower, flat faced follower.

Module-5

Spur Gears: Gear terminology, law of gearing, path of contact, arc of contact, contact ratio of spur gear. Interference in involute gears, methods of avoiding interference, condition and expressions for minimum number of teeth to avoid interference.

Gear Trains: Simple gear trains, compound gear trains. Epicyclic gear trains: Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains, torque calculation in epicyclic gear trains.

Course Outcomes: At the end of the course the student will be able to:

CO1: Knowledge of mechanisms and their motion.

CO2: Understand the inversions of four bar mechanisms.

CO3: Analyse the velocity, acceleration of links and joints of mechanisms.

CO4: Analysis of cam follower motion for the motion specifications.

CO5: Understand the working of the spur gears. CO6: Analyse the gear trains speed ratio and torque.				
Question paper pattern: • The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks. • There will be two full questions (with a maximum of four sub- questions) from each module. • Each full question will have sub- question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module.				
Sl No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbook/s				
1	Theory of Machines Kinematics and Dynamics	Sadhu Singh	Pearson	Third edition 2019
2	Mechanism and Machine Theory	G. Ambekar	PHI	2009
Reference Books				
1	Theory of Machines	Rattan S.S	Tata McGraw-Hill Publishing Company	2014
2	Mechanisms and Machines-Kinematics, Dynamics and Synthesis	Michael M Stanisic	Cengage Learning	2016

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B. E. MECHANICAL ENGINEERING **Choice Based Credit System (CBCS) and Outcome Based Education (OBE)** **SEMESTER – IV**			
METAL CUTTING AND FORMING			
Course Code	**18ME35A/45A**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To enrich the knowledge pertaining to relative motion and mechanics required for various machine tools.
- To introduce students to different machine tools to produce components having different shapes and sizes.
- To develop the knowledge on mechanics of machining process and effect of various parameters on machining.
- To acquaint with the basic knowledge on fundamentals of metal forming processes
- To study various metal forming processes.

Module-1

Introduction to Metal cutting: Orthogonal and oblique cutting. Classification of cutting tools: single, and multipoint; tool signature for single point cutting tool. Mechanics of orthogonal cutting; chip formation, shear angle and its significance, Merchant circle diagram. Numerical problems.
Cutting tool materials and applications.
Introduction to basic metal cutting machine tools: Lathe- Parts of lathe machine, accessories of lathe machine, and various operations carried out on lathe. Kinematics of lathe. Turret and Capstan lathe.

Module-2

Milling: Various Milling operation, classification of milling machines, Vertical & Horizontal milling, up milling & down milling. Indexing: need of indexing, simple, compound & differential indexing.
Drilling: Difference between drilling, boring & reaming, types of drilling machines. Boring operations & boring machines.
Shaping, Planing and Slotting machines-machining operations and operating parameters.
Grinding: Grinding operation, classification of grinding processes: cylindrical, surface & centerless grinding

Module-3

Introduction to tool wear, tool wear mechanisms, tool life equations, effect of process parameters on tool life, machinability. Cutting fluid-types and applications, surface finish, effect of machining parameters on surface finish. Economics of machining process, choice of cutting speed and feed, tool life for minimum cost and production time. Numerical problems.

Module-4

MECHANICAL WORKING OF METALS Introduction to metal forming processes & classification of metal forming processes. Hot working & cold working of metals.
Forging: Smith forging, drop forging & press forging. Forging Equipment, Defects in forging.
Rolling: Rolling process, Angle of bite, Types of rolling mills, Variables of rolling process, Rolling defects.
Drawing & Extrusion: Drawing of wires, rods & pipes, Variables of drawing process. Difference between drawing & extrusion. Various types of extrusion processes.

Module-5

Sheet Metal Operations: Blanking, piercing, punching, drawing, draw ratio, drawing force, variables in drawing, Trimming, and Shearing.
Bending — types of bending dies, Bending force calculation, Embossing and coining.
Types of dies: Progressive, compound and combination dies.

Course Outcomes:

At the end of the course the student will be able to:

CO1: Explain the construction & specification of various machine tools.
CO2: Discuss different cutting tool materials, tool nomenclature & surface finish.
CO3: Apply mechanics of machining process to evaluate machining time.

CO4: Analyze tool wear mechanisms and equations to enhance tool life and minimize machining cost. CO5: Understand the concepts of different metal forming processes. CO6: Apply the concepts of design of sheet metal dies to design different dies for simple sheet metal components.				

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. N	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Manufacturing Technology Vol I & II	P.N.Rao	Tata McGraw Hill Pub. Co. Ltd., New Delhi	1998
2	A textbook of Production Technology Vol I and II	Sharma, P.C.,	S. Chand & Company Ltd., New Delhi	1996
3	Manufacturing Science	Amithab Gosh &A K Malik	East-West press	2001
Reference Books				
3	Workshop Technology Vol. I and II	Chapman W. A. J.	Arnold Publisher New Delhi	1998
4	Elements of Manufacturing Technology Vol II,	Hajra Choudhary, S. K. and Hajra Choudhary, A. K.	Media Publishers, Bombay	1988
5	Metal Forming Handbook	Schuler	Springer Verlag Publication	
6	Metal Forming: Mechanics and Metallurgy	Hosford,WF and Caddell,R.M	Prentice Hall	1993
7	Manufacturing Engineering and Technology	Kalpakjian	Addision Wesley Congmen Pvt. Ltd.	2000
8	Production Technology	HMT		

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B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – IV

METAL CASTING AND WELDING

Course Code	**18ME35B/45B**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To provide adequate knowledge of quality test methods conducted on welded and cast components.
- To provide knowledge of various casting process in manufacturing.
- To provide in-depth knowledge on metallurgical aspects during solidification of metal and alloys.
- To provide detailed information about the moulding processes.
- To impart knowledge of various joining process used in manufacturing.
- To impart knowledge about behaviour of materials during welding, and the effect of process parameters in welding,

Module-1

Introduction & basic materials used in foundry:
Introduction: Definition, Classification of manufacturing processes. Metals cast in the foundry-classification, factors that determine the selection of a casting alloy.
Introduction to casting process & steps involved:
Patterns: Definition, classification, materials used for pattern, various pattern allowances and their importance.
Sand moulding: Types of base sand, requirement of base sand. Binder, Additives definition, need and types; preparation of sand moulds. Melding machines- Jolt type, squeeze type and Sand slinger.
Study of important moulding process: Green sand, core sand, dry sand, sweep mould, CO_2mould, shell mould, investment mould, plaster mould, cement bonded mould.
Cores: Definition, need, types. Method of making cores,
Concept of gating (top, bottom, parting line, horn gate) and risers (open, blind) Functions and types.

Module-2

MELTING & METAL MOLD CASTING METHODS:
Melting furnaces: Classification of furnaces, Gas fired pit furnace, Resistance furnace, Coreless induction furnace, electric arc furnace, constructional features & working principle of cupola furnace.
Casting using metal moulds: Gravity die casting, pressure die casting, centrifugal casting, squeeze casting, slush casting, thixocasting, and continuous casting processes.

Module-3

SOLIDIFICATION & NON-FERROUS FOUNDRY PRACTICE: Solidification: Definition, nucleation, solidification variables. Directional solidification-need and methods. Degasification in liquid metals-sources of gas, degasification methods.
Fettling and cleaning of castings: Basic steps involved. Sand Casting defects- causes, features and remedies. Advantages & limitations of casting process
Nonferrous foundry practice: Aluminium castings - advantages, limitations, melting of Aluminium using lift-out type crucible furnace. Hardeners used, drossing, gas absorption, fluxing and flushing, grain refining, pouring temperature. Stir casting set up, procedure, uses, advantages and limitations

Module-4

Welding process: Definition, Principles, classification, application, advantages & limitations of welding. Arc welding: Principle, Metal arc welding (MAW), Flux Shielded Metal Arc Welding (FSMAW), Inert Gas Welding (TIG & MIG) Submerged Arc Welding (SAW) and Atomic Hydrogen Welding (AHW).
Special type of welding: Resistance welding principles, Seam welding, Butt welding, Spot welding and Projection welding. Friction welding, Explosive welding, Thermit welding, Laser welding and Electron beam welding.

Module-5

METALLURGICAL ASPECTS IN WELDING, SOLDERING, AND BRAZING
Structure of welds, Formation of different zones during welding, Heat Affected Zone (HAZ), Parameters affecting HAZ. Effect of carbon content on structure and properties of steel, Shrinkage in welds& Residual stresses. Concept of electrodes, filler rod and fluxes. Welding defects- detection causes & remedy.
Soldering, brazing, gas welding: Soldering, Brazing, Gas Welding: Principle, oxy-Acetylene welding, oxy-hydrogen welding, air-acetylene welding, Gas cutting, powder cutting.
Inspection methods: Methods used for inspection of casting and welding. Visual, magnetic particle, fluorescent particle, ultrasonic. Radiography, eddy current, holography methods of inspection.

Course Outcomes: At the end of the course the student will be able to:
CO1: Describe the casting process and prepare different types of cast products.
CO2: Acquire knowledge on Pattern, Core, Gating, Riser system and to use Jolt, Squeeze, Sand Slinger moulding machines.
CO3: Compare the Gas fired pit, Resistance, Coreless, Electrical and Cupola Metal Furnaces.
CO4: Compare the Gravity, Pressure die, Centrifugal, Squeeze, slush and Continuous Metal mould castings.
CO5: Understand the Solidification process and Casting of Non-Ferrous Metals.
CO6: Describe the Metal Arc, TIG, MIG, Submerged and Atomic Hydrogen Welding processes etc. used in manufacturing.
CO7: Describe methods for the quality assurance of components made of casting and joining process

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Principles of metal casting	Rechard W. Heine, Carl R. Loper Jr., Philip C. Rosenthal	Tata McGraw Hill Education Private Limited	1976
2	Manufacturing Process-I	Dr. K. Radhakrishna	Sapna Book House,	5th Revised Edition 2009.
3	Manufacturing Technology-Foundry, Forming and Welding	P.N.Rao	Tata McGraw Hill	3rd Ed., 2003.
Reference Books				
4	Process and Materials of Manufacturing	Roy A Lindberg	Pearson Edu	4th Ed. 2006
5	Manufacturing Technology	SeropeKalpakjianSteuen. R Sechmid	Pearson Education Asia	5th Ed. 2006

B. E. MECHANICAL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - IV			
COMPUTER AIDED MACHINE DRAWING			
Course Code	**18ME36A/46A**	CIE Marks	40
Teaching Hours/Week (L:T:P)	1:4:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To acquire the knowledge of CAD software and its features.
- To familiarize the students with Indian Standards on drawing practices.
- To impart knowledge of thread forms, fasteners, keys, joints and couplings.
- To make the students understand and interpret drawings of machine components leading to preparation of assembly drawings manually and using CAD packages.
- To acquire the knowledge of limits, tolerance and fits and indicate them on machine drawings.

Part A

Part A

Introduction:

Review of graphic interface of the software. Review of basic sketching commands and navigational commands. Starting a new drawing sheet. Sheet sizes. Naming a drawing, Drawing units, grid and snap. Conversion of pictorial views into orthographic projections of simple machine parts (with and without section). Hidden line conventions. Precedence of lines.

Sections of Solids: Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on axis inclinations, spheres and hollow solids). True shape of sections.

Conversion of pictorial views into orthographic projections of simple machine parts. Hidden line conventions. Precedence of lines.

Conversion of pictorial views into orthographic projections of simple machine parts (with section planes indicated on the part).

Thread Forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External), BSW (Internal & External) square and Acme. Sellers thread, American Standard thread.

Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw.

Part B

Keys: Parallel key, Taper key, Feather key, Gib-head key and Woodruff key.

Joints: Cotter joint (socket and spigot), knuckle joint (pin joint) for two rods.

Couplings: Split Muff coupling, Protected type flanged coupling, pin (bush) type flexible coupling, and universal coupling (Hooks' Joint)

Part C

Limits, Fits and Tolerances: Introduction, Fundamental tolerances, Deviations, Methods of placing limit dimensions, machining symbols, types of fits with symbols and applications, geometrical tolerances on drawings. Standards followed in industry.

Assembly Drawings: (Part drawings shall be given)

1. Plummer block (Pedestal Bearing)
2. Lever Safety Valve
3. I.C. Engine connecting rod
4. Screw jack (Bottle type)
5. Tailstock of lathe
6. Machine vice
7. Tool head of shaper

Course Outcomes: At the end of the course the student will be able to:

CO1: Identify the national and international standards pertaining to machine drawing.

CO2: Understand the importance of the linking functional and visualization aspects in the preparation of the part drawings

CO3: Apply limits and tolerances to assemblies and choose appropriate fits for given assemblies.

CO4: Interpret the Machining and surface finish symbols on the component drawings.

CO5: Preparation of the part or assembly drawings as per the conventions.

Scheme of Examination: Two questions to be set from each Part A, part B and Part C. Student has to answer one question each from Part A and Part B for 25 marks each and one question from Part C for 50 marks.

INSTRUCTION FOR COMPUTER AIDED MACHINE DRAWING (15ME36A/46A) EXAMINATION

1. No restriction of timing for sketching/ computerization of solutions. The total duration is 3 hours.
2. It is desirable to do sketching of all the solutions before computerization.
3. Drawing instruments may be used for sketching.
4. For Part A and Part B, 2D drafting environment should be used.
5. For Part C, 3D environment should be used for parts and assembly, and extract 2D views of assembly.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Machine Drawing	K.R. Gopala Krishna	Subhash Publication	2005
2	Machine Drawing	N.D.Bhat&V.M.P anchal	Charoratar publishing house	2005
Reference Books				
3	A Text Book of Computer Aided Machine Drawing	S. Trymbaka Murthy	CBS Publishers, New Delhi	2007
4	Engineering drawing	P.S.Gill	S K Kataria and Sons	2013
5	Machine Drawing	N. Siddeshwar, P. Kanniah, V.V.S. Sastri	Tata McGraw Hill	2006

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B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

MECHANICAL MEASUREMENTS AND METROLOGY

Course Code	**18ME36B/46B**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To understand the concept of metrology and standards of measurement.
- To equip with knowledge of limits, fits, tolerances and gauging
- To acquire knowledge of linear and Angular measurements, Screw thread and gear measurement & comparators.
- To understand the knowledge of measurement systems and methods with emphasis on different Transducers, intermediate modifying and terminating devices.
- To understand the measurement of Force, Torque, Pressure, Temperature and Strain.

Module-1

Introduction to Metrology: Definition, objectives of metrology, Material Standards, Wavelength Standards, Classification of standards, Line and End standards, Calibration of End bars. Numerical examples.

Liner measurement and angular measurements: Slip gauges-Indian standards on slip gauges, Adjustable slip gauges, Wringing of slip gauges, Problems on building of slip gauges (M87, M112), Measurement of angle-sine bar, Sine centre, Angle gauges, Optical instruments for angular measurements. Autocollimator-Applications for measuring straightness and squareness.

Module-2

System of Limits, Fits, Tolerance and Gauging: Definitions, Tolerance, Tolerance analysis (addition & subtraction of tolerances) Inter change ability & Selective assembly. Class &grade of tolerance, Fits, Types of fits, Numerical on limits, fit and tolerance. Hole base system & shaft base system. Taylor's principle, Types of limit gauges, Numerical on limit gauge design.
Comparators: Functional requirements, Classification, Mechanical- Johnson Mikrokator, Sigma comparators, Dial indicator, Electrical comparators, LVDT, Pneumatic comparators- Principle of back pressure, Solex comparators, Optical comparators- Zeiss ultra- optimeter.

Module-3

Measurement of screw thread and gear: Terminology of screw threads, Measurement of major diameter, Minor diameter, Pitch, Angle and Effective diameter of screw threads by 2- wire and 3-wire methods, Best size wire. Screw thread gauges, Toolmaker's microscope.
Gear tooth Measurements: Tooth thickness measurement using constant chord method, Addendum, Comparator method and Base tangent method, Measurement of pitch, Concentricity, Run out and In volute profile. Gear roll tester for composite error.

Module-4

Measurement system and basic concepts of measurement methods: Definition, Significance of measurement, generalized measurement system, Static characteristics- Accuracy, Precision, Calibration, Threshold, Sensitivity, Hysteresis, Repeatability, Linearity, Loading effect, Dynamic characteristics- System response, Time delay. Errors in measurement, Classification of errors.
Transducers: Transfer efficiency, Primary and Secondary transducers, Electrical transducers, Mechanical transducers, Electronic transducers, Relative comparison of each type of transducers.
Intermediate Modifying and Terminating Devices: Mechanical systems, Inherent problems, Electrical intermediate modifying devices, Input circuitry, Ballast circuit, Electronic amplifiers. Terminating devices, Cathode ray oscilloscope,Oscillographs.

Module-5

Applied mechanical measurement: Measurement of force, Torque, Pressure, Types of Dynamometers, Absorption dynamometer, Prony brake and Rope brake dynamometer, and Power Measuring Instruments. Use of elastic members, Bridgeman gauge, McLeod gauge, Pirani gauge.

Measurement of strain and temperature: Theory of strain gauges, Types, Electrical resistance strain gauge, Preparation and mounting of Strain gauges, Gauge factor, Methods of strain measurement, temperature compensation, Resistance thermometers, Thermocouple, Law of thermocouple, Pyrometer, Optical pyrometer.

Course Outcomes: At the end of the course the student will be able to:

CO1: Understand the objectives of metrology, methods of measurement, standards of measurement & various measurement parameters.

CO2: Explain tolerance, limits of size, fits, geometric and position tolerances, gauges and their design

CO3: Understand the working principle of different types of comparators.

CO3: Describe measurement of major & minor diameter, pitch, angle and effective diameter of screw threads.

CO4: Explain measurement systems, transducers, intermediate modifying devices and terminating devices..

CO5: Describe functioning of force, torque, pressure, strain and temperature measuring devices.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Mechanical Measurements	Beckwith Marangoni and Lienhard	Pearson Education	6th Ed., 2006
2	Instrumentation, Measurement and Analysis	B C Nakra, K K Chaudhry	McGraw–Hill	4th Edition
3	Engineering Metrology	R.K. Jain	Khanna Publishers	2009
Reference Books				
1	Engineering Metrology and Measurements	Bentley	PearsonEducation	
2	Theory and Design for Mechanical Measurements, III edition	Richard S Figliola, Donald E Beasley	WILEY IndiaPublishers	
3	Engineering Metrology	Gupta I.C	Dhanpat RaiPublications	
4	Deoblin's Measurement system,	Ernest Deoblin, Dhanesh manick	McGraw–Hill	
5	EngineeringMetrologyandMeasurements	N.V.RaghavendraandL.Krishnamurthy	Oxford UniversityPress.	

B. E. MECHANICAL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - IV			
MATERIAL TESTING LAB			
Course Code	**18MEL37A/47A**	CIE Marks	40
Teaching Hours /Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To learn the concept of the preparation of samples to perform characterization such as microstructure, volume fraction of phases and grain size.
- To understand mechanical behaviour of various engineering materials by conducting standard tests.
- To learn material failure modes and the different loads causing failure.
- To learn the concepts of improving the mechanical properties of materials by different methods like heat treatment, surface treatment etc.

Sl. No.	**Experiments**
	PART A
1	Preparation of specimen for Metallographic examination of different engineering materials. To report microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze & composites.
2	Heat treatment: Annealing, normalizing, hardening and tempering of steel. Metallographic specimens of heat treated components to be supplied and students should report microstructures of furnace cooled, water cooled, air cooled, tempered steel. Students should be able to distinguish the phase changes in a heat treated specimen compared to untreated specimen.
3	Brinell, Rockwell and Vickers's Hardness tests on untreated and heat treated specimens.
4	To study the defects of Cast and Welded components using Non-destructive tests like: d) Ultrasonic flaw detection e) Magnetic crack detection f) Dye penetration testing.
	PART B
5	Tensile, shear and compression tests of steel, aluminum and cast iron specimens using Universal Testing Machine
6	Torsion Test on steel bar.
7	Bending Test on steel and wood specimens.
8	Izod and Charpy Tests on Mild steel and C.I Specimen.
9	To study the wear characteristics of ferrous and non-ferrous materials under different parameters.
10	Tensile, shear and compression tests of steel, aluminum and cast iron specimens using Universal Testing Machine
11	Fatigue Test (demonstration only).

Course Outcomes: At the end of the course the student will be able to:

CO1: Acquire experimentation skills in the field of material testing.

CO2: Develop theoretical understanding of the mechanical properties of materials by performing experiments.

CO3: Apply the knowledge to analyse a material failure and determine the failure inducing agent/s.

CO4: Apply the knowledge of testing methods in related areas.

CO5: Understand how to improve structure/behaviour of materials for various industrial applications.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

Scheme of Examination:

ONE question from part -A:	30 Marks
ONE question from part -B:	50 Marks
Viva -Voice:	20 Marks
Total:	100 Marks

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

MECHANICAL MEASUREMENTS AND METROLOGY LAB

Course Code	**18MEL37B/47B**	CIE Marks	40
Teaching Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To illustrate the theoretical concepts taught in Mechanical Measurements & Metrology through experiments.
- To illustrate the use of various measuring tools & measuring techniques.
- To understand calibration techniques of various measuring devices.

Sl. No.	Experiments
	PART A
1	Calibration of Pressure Gauge
2	Calibration of Thermocouple
3	Calibration of LVDT
4	Calibration of Load cell
5	Determination of modulus of elasticity of a mild steel specimen using strain gauges.
	PART B
6	Measurements using Optical Projector / Toolmakers' Microscope.
7	Measurement of angle using Sine Centre / Sine bar / bevel protractor
8	Measurement of alignment using Autocollimator / Roller set
9	Measurement of cutting tool forces using: Lathe tool Dynamometer Drill tool Dynamometer.
10	Measurements of Screw thread parameters using two wire or three-wire methods.
11	Measurements of surface roughness using Tally Surf/Mechanical Comparator
12	Measurement of gear tooth profile using gear tooth Vernier/Gear tooth micrometer
13	Calibration of Micrometer using slip gauges
14	Measurement using Optical Flats

Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand Calibration of pressure gauge, thermocouple, LVDT, load cell, micrometer.
CO2: Apply concepts of Measurement of angle using Sine Centre/ Sine Bar/ Bevel Protractor, alignment using Autocollimator/ Roller set.
CO3: Demonstrate measurements using Optical Projector/Tool maker microscope, Optical flats.
CO4: Analyse tool forces using Lathe/Drill tool dynamometer.
CO5: Analyse Screw thread parameters using 2-Wire or 3-Wire method, gear tooth profile using gear tooth Vernier/Gear tooth micrometer
CO6: Understand the concepts of measurement of surface roughness.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.

Scheme of Examination:

ONE question from part -A: 30 Marks
ONE question from part -B: 50 Marks
Viva -Voice: 20 Marks
Total: 100 Marks

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

WORKSHOP AND MACHINE SHOP PRACTICE

Course Code	**18MEL38A/48A**	CIE Marks	40
Teaching Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To guide students to use fitting tools to perform fitting operations.
- To provide an insight to different machine tools, accessories and attachments.
- To train students into fitting and machining operations to enrich their practical skills.
- To inculcate team qualities and expose students to shop floor activities.
- To educate students about ethical, environmental and safety standards.

Sl. No.	**Experiments**
	PART A
1	Preparation of at least two fitting joint models by proficient handling and application of hand tools- V-block, marking gauge, files, hack saw drills etc.
	PART B
2	Preparation of three models on lathe involving - Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, Drilling, Boring, Internal Thread cutting and Eccentric turning. Exercises should include selection of cutting parameters and cutting time estimation.
	PART C
3	Cutting of V Groove/ dovetail / Rectangular groove using a shaper. Cutting of Gear Teeth using Milling Machine. Exercises should include selection of cutting parameters and cutting time estimation.
	PART D (DEMONSTRATION ONLY)
	Study & Demonstration of power tools like power drill, power hacksaw, portable hand grinding, cordless screw drivers, production air tools, wood cutter, etc., used in Mechanical Engineering.

Course Outcomes: At the end of the course the student will be able to:

CO1: To read working drawings, understand operational symbols and execute machining operations.
CO2: Prepare fitting models according to drawings using hand tools- V-block, marking gauge, files, hack saw, drills etc.
CO3: Understand integral parts of lathe, shaping and milling machines and various accessories and attachments used.
CO4: Select cutting parameters like cutting speed, feed, depth of cut, and tooling for various machining operations.
CO5: Perform cylindrical turning operations such as plain turning, taper turning, step turning, thread Cutting, facing, knurling, internal thread cutting, eccentric turning and estimate cutting time.
CO6: Perform machining operations such as plain shaping, inclined shaping, keyway cutting, Indexing and Gear cutting and estimate cutting time.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

Scheme of Examination:	
One Model from Part-A or Part-C:	30 Marks
One Model from Part-B:	50 Marks
Viva – Voce:	20 Marks
TOTAL:	100 Marks

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

FOUNDRY, FORGING AND WELDING LAB

Course Code	**18MEL38B/48B**	CIE Marks	40
Teaching Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To provide an insight into different sand preparation and foundry equipment.
- To provide an insight into different forging tools and equipment and arc welding tools and equipment.
- To provide training to students to enhance their practical skills in welding, forging and hand moulding.

Sl. No.	Experiments
	PART A
1	**Testing of Molding sand and Core sand.** **Preparation of sand specimens and conduction of the following tests:** 1. Compression, Shear and Tensile tests on Universal Sand Testing Machine. 2. Permeability test 3. Sieve Analysis to find Grain Fineness Number (GFN) of Base Sand 4. Clay content determination on Base Sand. **Welding Practice:** Use of Arc welding tools and welding equipment Preparation of welded joints using Arc Welding equipment L-Joint, T-Joint, Butt joint, V-Joint, Lap joints on M.S. flats
	PART B
2	**Foundry Practice:** **Use of foundry tools and other equipment for Preparation of molding sand mixture.** **Preparation of green sand molds kept ready for pouring in the following cases:** 4. Using two molding boxes (hand cut molds). 5. Using patterns (Single piece pattern and Split pattern). 6. Incorporating core in the mold.(Core boxes). • Preparation of one casting (Aluminium or cast iron-Demonstration only)
	PART C
3	**Forging Operations:** Use of forging tools and other forging equipment. • Calculation of length of the raw material required to prepare the model considering scale loss. • Preparing minimum three forged models involving upsetting, drawing and bending operations.

Course Outcomes: At the end of the course the student will be able to:

- Demonstrate various skills in preparation of molding sand for conducting tensile, shear and compression tests using Universal sand testing machine.
- Demonstrate skills in determining permeability, clay content and Grain Fineness Number of base sands.
- Demonstrate skills in preparation of forging models involving upsetting, drawing and bending operations.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

Scheme of Examination:

1. One question is to be set from Part-A: 30 marks. (20 marks for sand testing+ 10 Marks for welding)
2. One question is to be set from either Part-B or Part-C: 50 Marks
3. Viva – Voce: 20 marks

Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand needs, functions, roles, scope and evolution of Management.

CO2: Understand importance, purpose of Planning and hierarchy of planning and also53nalyse its types.

CO3: Discuss Decision making, Organizing, Staffing, Directing and Controlling.

CO4: Select the best economic model from various available alternatives.

CO5: Understand various interest rate methods and implement the suitable one.

CO6: Estimate various depreciation values of commodities.

CO7: Prepare the project reports effectively.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the	Name of the Publisher	Edition and
Textbook/s				
1	Mechanical estimation and costing	T.R. Banga & S.C. Sharma	Khanna Publishers	17th edition 2015
2	Engineering Economy	Riggs J.L	McGraw Hill	4th
3	Engineering Economy	Thuesen H.G	PHI	2002
4	Principles of Management	Tripathy and Reddy	Tata McGraw Hill	3^{rd} edition 2006
Reference Books				
1	Management Fundamentals - Concepts, Application, Skill Development	Robers Lusier Thomson	Pearson Education	
2	Modern Economic Theory	Dr. K. K. Dewett& M. H. Navalur,	Chand Publications	
3	Economics: Principles of Economics	N Gregory Mankiw,	Cengage Learning	
4	Basics of Engineering Economy	Leland Blank & Anthony Tarquin	McGraw Hill Publication (India) Private Limited	

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B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

MANAGEMENT AND ECONOMICS

Course Code	**18ME51**	CIE Marks	40
Teaching Hours/Week (L:T:P)	2:2:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To help the students to understand the fundamental concepts and principles of management; the basic roles, skills, functions of management, various organizational structures and basic knowledge of marketing.
- To impart knowledge, with respect to concepts, principles and practical applications of Economics, which govern the functioning of a firm/organization under different market conditions.

Module-1

Management: Introduction - Meaning - nature and characteristics of Management, Scope and Functional areas of management - Management as a science, art of profession - Management & Administration - Roles of Management, Levels of Management, Development of Management Thought- early management approaches – Modern management approaches. Planning: Nature, importance and purpose of planning process Objectives - Types of plans (Meaning Only) - Decision making Importance of planning - steps in planning & planning premises - Hierarchy of plans.

Module-2

Organizing and Staffing: Nature and purpose of organization Principles of organization - Types of organization - Departmentation Committees Centralization Vs Decentralization of authority and responsibility - Span of control - MBO and MBE (Meaning Only) Nature and importance of staffing--Process of Selection & Recruitment (in brief). Directing & Controlling: Meaning and nature of directing Leadership styles, Motivation Theories, Communication - Meaning and importance - coordination, meaning and importance and Techniques of Co Ordination. Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control (in brief).

Module-3

Introduction: Engineering and economics, Problem solving and decision making, Laws of demand and supply, Difference between Microeconomics & Macroeconomics, equilibrium between demand & supply, elasticity of demand, price elasticity, income elasticity. Law of Returns, Interest and interest factors, simple and compound interest, Cash flow diagrams, personal loans and EMI payment calculation with flexible interest rates, Discussion and problems.

Module-4

Present, future and annual worth and rate of returns: Basic present worth comparisons, Present worth-equivalence, Assets with unequal lives and infinites lives, future worth comparisons, payback comparisons, Equivalent annual worth comparisons, situations for annual worth comparisons. Asset life, Rate of return, minimum acceptable rate of return, IRR anomalies and misconceptions, Cost of capital, comparisons of all present future and annual worth with IRR, product costing, Discussions and problems.

Module-5

Costing and depreciation: Components of costs, estimation of selling price, marginal cost, first cost, all kinds of overheads, indirect cost estimation with depreciation, mensuration and estimation of material cost, cost estimation of mechanical process, idling time. Product costing (approaches to product costing), causes of depreciation, methods of computing depreciation charges, straight line method, declining balance method, sum of years method, sinking fund method, service output methods, taxation concepts, personal income taxes and corporate taxes, Discussions and problems.

Course outcomes: At the end of the course, the student will be able to:

CO1: Understand needs, functions, roles, scope and evolution of Management

CO2: Understand importance, purpose of Planning and hierarchy of planning and also54nalyse its types.

CO3: Discuss Decision making, Organizing, Staffing, Directing and Controlling.

CO4: Select the best economic model from various available alternatives.

CO5: Understand various interest rate methods and implement the suitable one.

CO6: Estimate various depreciation values of commodities.

CO7: Prepare the project reports effectively.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the	Edition and Year
Textbook/s				
1	Mechanical estimation	T.R. Banga& S.C. Sharma	Khanna Publishers	17th edition
2	Engineering Economy	Riggs J.L	McGraw Hill	4th edition
3	Engineering Economy	Thuesen H.G	PHI	2002
4	Principles of Management	Tripathy and Reddy	Tata McGraw Hill	3^{rd} edition 2006
Textbook/s				
1	Mechanical estimation	T.R. Banga& S.C. Sharma	Khanna Publishers	17th edition
2	Engineering Economy	Riggs J.L	McGraw Hill	4th edition
3	Engineering Economy	Thuesen H.G	PHI	2002
4	Principles of Management	Tripathy and Reddy	Tata McGraw Hill	3^{rd} edition 2006

B. E. MECHANICAL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - V			
DESIGN OF MACHINE ELEMENTS I			
Course Code	**18ME52**	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

- To understand the various steps involved in the Design Process.
- To explain the principles involved in design of machine elements, subjected to different kinds of forces, from the considerations of strength, rigidity, functional and manufacturing requirements.
- To understand and interpret different failure modes and application of appropriate criteria for design of machine elements.
- To learn to use national and international standards, standard practices, standard data, catalogs, and standard components used in design of machine elements.
- Develop the capability to design elements like shafts, couplings, welded joints, screwed joints, and power screws.

Module-1

Introduction: Design Process: Definition of design, phases of design, and review of engineering materials and their properties and manufacturing processes; use of codes and standards, selection of preferred sizes.

Review of axial, bending, shear and torsion loading on machine components, combined loading, two- and three dimensional stresses, principal stresses, stress tensors, Mohr's circles.

Design for static strength: Factor of safety and service factor.

Failure mode: definition and types. , Failure of brittle and ductile materials; even and uneven materials; Theories of failure: maximum normal stress theory, maximum shear stress theory, distortion energy theory, strain energy theory, Columba –Mohr theory and modified Mohr's theory. Stress concentration, stress concentration factor and methods of reducing stress concentration.

Module-2

Impact Strength: Introduction, Impact stresses due to axial, bending and torsion loads.

Fatigue loading: Introduction to fatigue failure, Mechanism of fatigue failure, types of fatigue loading, S-N Diagram, Low cycle fatigue, High cycle fatigue, Endurance limit.

Modifying factors: size effect, surface effect, Stress concentration effects Notch sensitivity, Soder berg and Goodman relationships, stresses due to combined loading, cumulative fatigue damage, and Miner's equation.

Module-3

Design of shafts: Torsion of shafts, solid and hollow shaft design with steady loading based on strength and rigidity, ASME and BIS codes for power transmission shafting, design of shafts subjected to combined bending, torsion and axial loading. Design of shafts subjected to fluctuating loads

Design of keys and couplings :Keys: Types of keys and their applications, design considerations in parallel and tapered sunk keys, Design of square and rectangular sunk keys.

Couplings: Rigid and flexible coupling-types and applications, design of Flange coupling, and Bush and Pin type coupling.

Module-4

Design of Permanent Joints: Types of permanent joints-Riveted and Welded Joints.

Riveted joints: Types of rivets, rivet materials, Caulking and fullering, analysis of riveted joints, joint efficiency, failures of riveted joints, boiler joints, riveted brackets.

Welded joints: Types, strength of butt and fillet welds, eccentrically loaded welded joints

Module-5

Design of Temporary Joints: Types of temporary joints- cotter joints, knuckle joint and fasteners. Design of Cotter and Knuckle Joint.

Threaded Fasteners: Stresses in threaded fasteners, effect of initial tension, design of threaded fasteners under static, dynamic and impact loads, design of eccentrically loaded bolted joints.

Power screws: Mechanics of power screw, stresses in power screws, efficiency and self-locking, design of power screws.

Assignment:

Course work includes a **Design project**. Design project should enable a group of students (maximum four in a group) to design a mechanical system (like couplings, screw jack, welded joints, bracket mounting using fasteners, etc.). Student should submit assembly drawing and part drawings, completely dimensioned, indicating the necessary manufacturing tolerances, surface finish symbols and geometric tolerances wherever necessary. Design project must be completed using appropriate solid modeling software. Computer generated drawings must be submitted. Design calculations must be hand written and should be included in the report.

Design project should be given due credit in internal assessment.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Apply the concepts of selection of materials for given mechanical components.

CO2: List the functions and uses of machine elements used in mechanical systems.

CO3: Apply codes and standards in the design of machine elements and select an element based on the Manufacturer's catalogue.

CO4: Analyse the performance and failure modes of mechanical components subjected to combined loading and fatigue loading using the concepts of theories of failure.

CO5: Demonstrate the application of engineering design tools to the design of machine components like shafts, couplings, power screws, fasteners, welded and riveted joints.

CO6: Understand the art of working in a team.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the	Edition and Year
Textbook/s				
1	Shigley's Mechanical Engineering Design	Richard G. Budynas, and J. Keith Nisbett	McGraw-Hill Education	10^{th} edition, 2015.
2	Fundamentals of Machine Component Design	Juvinall R.C, and Marshek K.M.	John Wiley & Sons	Third Edition, 2007 student
3	Design of Machine Elements,	V B Bhandari	Tata McGraw Hill	4th Ed., 2016.
4	Design of Machine Elements-I	Dr.M H Annaiah Dr. J Suresh Kumar	New Age International (P)	1s Ed., 2016
Reference Books				
1	Machine Design- an integrated approach	Robert L. Norton	Pearson Education	2^{nd} edition.
2	Design and Machine Elements	Spotts M.F., Shoup T.E	Pearson Education	8^{th} edition,2006
3	Machine Component Design	Orthwein W	Jaico Publishing Co	2003
4	Machine Design	Hall, Holowenko, Laughlin (Schaum's Outline series)	Tata McGraw Hill Publishing	Special Indian Edition, 2008
5	Elements of Machine Design	H.G.Patil, S.C.Pilli, R.R.Malagi, M.S.Patil	IK International	First edition,2019

6	Design of Machine Elements Volume I	T. Krishna Rao	IK international publishing house,	2012
7	Hand book of Mechanical Design	G. M. Maithra and L.V.Prasad	Tata McGraw Hill	2nd edition, 2004.

Design Data Hand Book:

[1] Design Data Hand Book, K. Lingaiah, McGraw Hill, 2nd edition, 2003.
[2] Design Data Hand Book, K. Mahadevan and Balaveera Reddy, CBS publication.
[3] Design Data Hand Book, H.G.Patil, I. K. International Publisher, 2010
[4] PSG Design Data Hand Book, PSG College of technology, Coimbatore.

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

DYNAMICS OF MACHINES

Course Code	**18ME53**	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

- To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.
- To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism.
- To understand the effect of Dynamics of undesirable vibrations.
- To understand the principles in mechanisms used for speed control and stability control.
- To know the concepts of modelling mechanical systems using spring, mass and damper elements.
- To compute the natural and damped frequencies of free 1-DOF mechanical systems
- To analyze the vibrational motion of 1-DOF mechanical systems under harmonic excitation conditions.

Module-1

Static force analysis: Static equilibrium, analysis of four bar mechanism, slider crank mechanism, shaper mechanism. **Dynamic force analysis:** D'Alembert's principle, analysis of four bar and slider crank mechanism, shaper mechanism.

Module-2

Balancing of Rotating Masses: Static and Dynamic Balancing, Balancing of single rotating mass by balancing masses in same plane and in different planes. Balancing of several rotating masses by balancing masses in same plane and in different planes.

Balancing of Reciprocating Masses: Inertia Effect of crank and connecting rod, Single cylinder Engine, Balancing in multi cylinder-inline engine (primary and secondary forces), V-type engine, Radial engine – direct and reverse crank method.

Module-3

Governors: Types of Governors; Force Analysis of Porter and Hartnell Governors. Controlling Force, Stability, Sensitiveness, Isochronism, Effort and Power.

Gyroscope: Vectorial representation of angular motion, Gyroscopic couple. Effect of gyroscopic Couple on plane disc, ship, aeroplane, Stability of two wheelers and four wheelers.

Module-4

Free vibrations: Basic elements of vibrating system, Types of free vibrations, Longitudinal vibrations-Equilibrium method, D'Alembert's principle, Energy method, Rayleigh's method. Determination of natural frequency of single degree freedom systems, Effect of spring mass, Damped free vibrations: Under damped, over damped and critically damped systems. Logarithmic decrement.

Module-5

Forced vibrations: Undamped forced vibration of spring mass system, Damped forced vibrations, Rotating unbalance, Reciprocating unbalance, Vibration isolation, Support motion(absolute and relative motion), Transverse vibration of shaft with single concentrated load, several loads, uniformly distributed load, Critical speed.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Analyse the mechanisms for static and dynamic equilibrium.

CO2: Carry out the balancing of rotating and reciprocating masses

CO3: Analyse different types of governors used in real life situation.

CO4: Analyse the gyroscopic effects on disks, airplanes, stability of ships, two and four wheelers

CO5: Understand the free and forced vibration phenomenon.

CO6: Determine the natural frequency, force and motion transmitted in vibrating systems.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Theory of Machines: Kinematics and Dynamics	Sadhu Singh	Pearson	Third edition 2019.
2	Mechanism and Machine Theory	G. Ambekar	PHI	2009
Reference Books				
1	Theory of Machines	Rattan S.S.	Tata McGraw-Hill Publishing Company	2014
2	Mechanisms and Machines- Kinematics, Dynamics and Synthesis	Michael M Stanisic	Cengage Learning	2016

B. E. MECHANICAL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - V			
TURBO MACHINES			
Course Code	**18ME54**	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- Understand typical design of Turbo machine, their working principle, application and thermodynamics process involved.
- Study the conversion of fluid energy to mechanical energy in Turbo machine with utilization factor and degree of reaction.
- Analyse various designs of steam turbine and their working principle.
- Study the various designs of hydraulic turbine based on the working principle.
- Understand the various aspects in design of power absorbing machine.

Module-1

Introduction: Definition of turbo machine, parts of turbo machines, Comparison with positive displacement machines, Classification, Dimensionless parameters and their significance, Unit and specific quantities, model studies and its numerical.

(Note: Since dimensional analysis is covered in Fluid Mechanics subject, questions on dimensional analysis may not be given. However, dimensional parameters and model studies may be given more weightage.)

Thermodynamics of fluid flow: Application of first and second law of thermodynamics to turbo machines, Efficiencies of turbo machines, Static and Stagnation states, overall isentropic efficiency, stage efficiency (their comparison) and polytropic efficiency for both compression and expansion processes. Reheat factor for expansion process. Simple Numerical on stage efficiency and polytropic efficiency.

Module-2

Energy exchange in Turbo machines: Euler's turbine equation, Alternate form of Euler's turbine equation, Velocity triangles for different values of degree of reaction, Components of energy transfer, Degree of Reaction, utilization factor, Relation between degree of reaction and Utilization factor, Problems.

General Analysis of Turbo machines: Radial flow compressors and pumps – general analysis, Expression for degree of reaction, velocity triangles, Effect of blade discharge angle on energy transfer and degree of reaction, Effect of blade discharge angle on performance, , General analysis of axial flow pumps and compressors, degree of reaction, velocity triangles, Numerical Problems.

Module-3

Steam Turbines: Classification, Single stage impulse turbine, condition for maximum blade efficiency, stage efficiency, Need and methods of compounding, Multi-stage impulse turbine, expression for maximum utilization factor, Numerical Problems.

Reaction turbine – Parsons's turbine, condition for maximum utilization factor, reaction staging. Numerical Problems

Module-4

Hydraulic Turbines: Classification, various efficiencies.

Pelton Wheel – Principle of working, velocity triangles, design parameters, maximum efficiency, and numerical problems.

Francis turbine – Principle of working, velocity triangles, design parameters, and numerical problems

Kaplan and Propeller turbines - Principle of working, velocity triangles, design parameters and Numerical Problems. Theory and types of Draft tubes.

Module-5

Centrifugal Pumps: Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump, Theoretical head – capacity relationship, Minimum speed for starting the flow, Maximum suction lift, Net positive suction head, Cavitation, Need for priming, Pumps in series and parallel. Problems.

Centrifugal Compressors: Stage velocity triangles, slip factor, power input factor, Stage work, Pressure developed, stage efficiency and surging and problems.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Model studies and thermodynamics analysis of turbomachines.

CO2: Analyse the energy transfer in Turbo machine with degree of reaction and utilisation factor.

CO3: Classify, analyse and understand various type of steam turbine.

CO4: Classify, analyse and understand various type of hydraulic turbine.

CO5: Understand the concept of radial power absorbing machine and the problems involved during its operation.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	An Introduction to Energy Conversion, Volume III, Turbo machinery	V. Kadambi and Manohar Prasad	New Age International Publishers	reprint 2008
2	Turbo Machines	B.U.Pai	Wiley India Pvt, Ltd	1st Edition
3	Turbo machines	M. S. Govindegowda and A. M. Nagaraj	M. M. Publications	7Th Ed, 2012
4	Fundamentals of Turbo Machinery	B.K Venkanna	PHI Publishers	
Reference Books				
1	Turbines, Compressors & Fans	S. M. Yahya	Tata McGraw Hill Co. Ltd	2nd edition, 2002
2	Principals of Turbo machines	D. G. Shepherd	The Macmillan Company	1964
3	Fluid Mechanics & Thermodynamics of Turbo machines	S. L. Dixon	Elsevier	2005

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B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

FLUID POWER ENGINEERING

Course Code	**18ME55**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To provide an insight into the capabilities of hydraulic and pneumatic fluid power.
- To understand concepts and relationships surrounding force, pressure, energy and power in fluid power systems.
- To examine concepts cantering on sources of hydraulic power, rotary and linear actuators, distribution systems, hydraulic flow in pipes, and control components in fluid power systems.
- Exposure to build and interpret hydraulic and pneumatic circuits related to industrial applications.
- To familiarize with logic controls and trouble shooting.

Module-1

Introduction to fluid power systems

Fluid power system: components, advantages and applications. Transmission of power at static and dynamic states. Pascal's law and its applications.

Fluids for hydraulic system: types, properties, and selection. Additives, effect of temperature and pressure on hydraulic fluid. Seals, sealing materials, compatibility of seal with fluids. Types of pipes, hoses, and quick acting couplings. Pressure drop in hoses/pipes. Fluid conditioning through filters, strainers; sources of contamination and contamination control; heat exchangers.

Module-2

Pumps and actuators

Pumps: Classification of pumps, Pumping theory of positive displacement pumps, construction and working of Gear pumps, Vane pumps, Piston pumps, fixed and variable displacement pumps, Pump performance characteristics, pump selection factors, problems on pumps.

Accumulators: Types, and applications of accumulators. Types of Intensifiers, Pressure switches /sensor, Temperature switches/sensor, Level sensor.

Actuators: Classification cylinder and hydraulic motors, Hydraulic cylinders, single and double acting cylinder, mounting arrangements, cushioning, special types of cylinders, problems on cylinders.

Construction and working of rotary actuators such as gear, vane, piston motors, and Hydraulic Motor. Theoretical torque, power, flow rate, and hydraulic motor performance; numerical problems. Symbolic

Module-3

Components and hydraulic circuit design Components:

Classification of control valves, Directional Control Valves-symbolic representation, constructional features of poppet, sliding spool, rotary type valves solenoid and pilot operated DCV, shuttle valve, and check valves.

Pressure control valves - types, direct operated types and pilot operated types.

Flow Control Valves -compensated and non-compensated FCV, needle valve, temperature compensated, pressure compensated, pressure and temperature compensated FCV, symbolic representation.

Hydraulic Circuit Design: Control of single and Double -acting hydraulic cylinder, regenerative circuit, pump unloading circuit, counter balance valve application, hydraulic cylinder sequencing circuits, hydraulic circuit for force multiplication; speed control of hydraulic cylinder- metering in, metering out and bleed off circuits. Pilot pressure operated circuits.

Module-4

Pneumatic power systems

Introduction to Pneumatic systems: Pneumatic power system, advantages, limitations, applications, Choice of working medium. Characteristics of compressed air and air compressors. Structure of pneumatic control System, fluid conditioners-dryers and FRL unit.

Pneumatic Actuators: Linear cylinder – types of cylinders, working, end position cushioning, seals, mounting arrangements, and applications. Rotary cylinders- types, construction and application, symbols.

Pneumatic Control Valves: DCV such as poppet, spool, suspended seat type slide valve, pressure control valves, flow control valves, types and construction, use of memory valve, Quick exhaust valve, time delay valve, shuttle valve, twin pressure valve, symbols.

Module-5

Pneumatic control circuits

Simple Pneumatic Control: Direct and indirect actuation pneumatic cylinders, speed control of cylinders - supply air throttling and exhaust air throttling.

Signal Processing Elements: Use of Logic gates - OR and AND gates in pneumatic applications. Practical examples involving the use of logic gates.

Multi- Cylinder Application: Coordinated and sequential motion control, motion and control diagrams. Signal elimination methods, Cascading method- principle, Practical application examples (up to two cylinders) using cascading method (using reversing valves).

Electro- Pneumatic Control: Principles - signal input and output, pilot assisted solenoid control of directional control valves, use of relay and contactors. Control circuitry for simple signal cylinder application.

Learning Assignment:

The faculty will allocate one or more of the following experiments from group A and B to group of students (containing not more than four students in a group):

Group A: Experiments on hydraulic trainer:

- a. Speed control circuit using metering in and metering out technique
- b. Regenerative and sequencing circuits.
- c. Extend-Retract and Stop system of a linear actuator
- d. Rapid Traverse and Feed circuit.

Group B: Experiments on pneumatic trainer:

- a. Automatic reciprocating circuit
- b. Speed control circuit
- c. Pneumatic circuit involving shuttle valve/ quick exhaust valve
- d. Electro pneumatic valves and circuit

Students should build up the above circuits on computer using software and simulate the flow of fluid during the operation. Afterwards, they themselves can physically connect the circuit on the hydraulic/pneumatic trainer and run the circuit. Record of experiments shall be submitted in the form of journal. Due credit must be given for this assignment.

Course Outcomes: At the end of the course, the student will be able to:

- CO1: Identify and analyse the functional requirements of a fluid power transmission system for a given application.
- CO2: Visualize how a hydraulic/pneumatic circuit will work to accomplish the function.
- CO3: Design an appropriate hydraulic or pneumatic circuit or combination circuit like electro-hydraulics, electro- pneumatics for a given application.
- CO4: Select and size the different components of the circuit.
- CO5: Develop a comprehensive circuit diagram by integrating the components selected for the given application.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Fluid Power with applications	Anthony Esposito	Pearson edition	2000
2	Oil Hydraulics	Majumdar S.R	Tala McGRawHIlL	2002
3	Pneumatic systems - Principles and Maintenance	Majumdar S.R	Tata McGraw-Hill	2005
Reference Books				
1	Industrial Hydraulics	John Pippenger, Tyler Hicks	McGraw Hill International Edition	1980
2	Hydraulics and pneumatics	Andrew Par	Jaico Publishing House	2005
3	Fundamentals of Pneumatics, Vol I, II and III.	FESTO		
4	Hydraulic Control Systems	Herbert E. Merritt	John Wiley and Sons, Inc	
5	Introduction to Fluid power	Thomson	PrentcieHall	2004
6	Fundamentals of fluid power control	John Watton	Cambridge University press	2012

B. E. MECHANICAL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - V			
OPERATIONS MANAGEMENT			
Course Code	**18ME56**	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To get acquainted with the basic aspects of Production Management.
- The expose the students to various aspects of planning, organising and controlling operations Management.
- To understand different operational issues in manufacturing and services organisations.
- To understand different problem-solving methodologies and Production Management techniques.

Module-1

Introduction, Functions within business organizations, the operation management function, Classification of production systems, Productivity, factors affecting productivity.

Decision Making: The decision process, characteristics of operations decisions, use of models, decision making environments, graphical linear programming, analysis and trade-offs.

Module-2

Forecasting: Steps in forecasting process, approaches to forecasting, forecasts based on judgment and opinion, analysis of time series data, accuracy and control of forecasts, choosing a forecasting technique, elements of a good forecast.

Module-3

Capacity & Location Planning: Importance of capacity decisions, defining and measuring capacity, determinants of effective capacity, determining capacity requirement, developing capacity alternatives, evaluating alternatives, Need for location decisions, nature of locations decisions, general procedure for making locations decisions, evaluating locations decisions, facilities layout – need for layout decisions, types of processing.

Module-4

Aggregate Planning & Master Scheduling: Aggregate planning – Nature and scope of aggregate planning, strategies of aggregate planning, techniques for aggregate planning – graphical and charting techniques, mathematical techniques. The master production schedule, Master scheduling process, Master scheduling methods.

Module-5

Material Requirement Planning (MRP): Dependent versus independent demand, an overview of MRP – MRF inputs and outputs, MRP processing, ERP capacity requirement planning, benefits and limitations of MRP.

Purchasing and Supply Chain Management (SCM): Introduction, Importance of purchasing and SCM, the procur process, Concept of tenders, Approaches to SCM, Vendor development.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Explain the concept and scope of operations management in a business context

CO2: Recognize the role of Operations management among various business functions and its role in the organizations' strategic planning and gaining competitive advantage.

CO3: Analyze the appropriateness and applicability of a range of operations management systems/models in decision making.

CO4: Assess a range of strategies for improving the efficiency and effectiveness of organizational operations.

CO5: Evaluate a selection of frameworks used in the design and delivery of operations

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.

- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. "Operation Management, Author- Joseph G Monks McGrew Hill Publication, International Edition-1987.
2. "Production and Operation Management" ,Author-Pannerselvam R. PHI publications, 2nd edition
3. "An Introductory book on lean System, TPS Yasuhiro Modern.

Reference Books:

1. "Production and Operation Management" Chary S. N. TataMcGrew Hill 3rd edition.
2. "Production and Operations Management", Everett E. Adams, Ronald J. Ebert, Prentice Hall of India Publications, Fourth Edition.
3. Modern Production/Operations Management, Buffia, Wiely India Ltd 4th Edition.

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER –V

FLUID MECHANICS AND MACHINES LAB

Course Code	**18MEL57**	CIE Marks	40
Teaching Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- This course will provide a basic understanding of flow measurements using various types of flow measuring devices, calibration and losses associated with these devices.
- Energy conversion principles, analysis and understanding of hydraulic turbines and pumps will be discussed. Application of these concepts for these machines will be demonstrated. Performance analysis will be carried out using characteristic curves.

Sl. No.	Experiments
	PART A
1	Lab layout, calibration of instruments and standards to be discussed
2	Determination of coefficient of friction of flow in a pipe.
3	Determination of minor losses in flow through pipes.
4	Application of momentum equation for determination of coefficient of impact of jets on flat and curved blades
5	Calibration of flow measuring devices.
	PART B
6	Performance on hydraulic Turbines a. Pelton wheel b. Francis Turbine c. Kaplan Turbines
7	Performance hydraulic Pumps d. Single stage and Multi stage centrifugal pumps e. Reciprocating pump.
8	Performance test on a two stage Reciprocating Air Compressor.
9	Performance test on an Air Blower.
	PART C (OPTIONAL)
10	Visit to Hydraulic Power station/ Municipal Water Pump House and Case Studies
11	Demonstration of cut section models of Hydraulic turbines and Pumps.

Course Outcomes: At the end of the course, the student will be able to:
CO1: Perform experiments to determine the coefficient of discharge of flow measuring devices.
CO2: Conduct experiments on hydraulic turbines and pumps to draw characteristics.
CO3: Test basic performance parameters of hydraulic turbines and pumps and execute the knowledge in real life situations.
CO4: Determine the energy flow pattern through the hydraulic turbines and pumps.
CO5: Exhibit his competency towards preventive maintenance of hydraulic machines.

Conduct of Practical Examination:
1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

Scheme of Examination:

ONE question from part A:	30	Marks
ONE question from part B:	50	Marks
Viva –Voice :	20	Marks
Total :	100	Marks

B. E. MECHANICAL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER –V			
ENERGY CONVERSION LABORATORY			
Course Code	**18MEL58**	CIE Marks	40
Teaching Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- This course will provide a basic understanding of fuel properties and its measurements using various types of measuring devices
- Energy conversion principles, analysis and understanding of I C Engines will be discussed. Application of these concepts for these machines will be demonstrated. Performance analysis will be carried out using characteristic curves.
- Exhaust emissions of I C Engines will be measured and compared with the standards.

Sl. No.	Experiments
	PART A
1	Lab layout, calibration of instruments and standards to be discussed
2	Determination of Flash point and Fire point of lubricating oil using Abel Pensky and Marten's (closed) / Cleveland's (Open Cup) Apparatus.
3	Determination of Calorific value of solid, liquid and gaseous fuels.
4	Determination of Viscosity of lubricating oil using Redwoods, Saybolt and Torsion Viscometers.
5	Valve Timing/port opening diagram of an I.C. Engine.
	PART B
6	Performance Tests on I.C. Engines, Calculations of IP, BP, Thermal efficiency, Volumetric efficiency, Mechanical efficiency, SFC, FP, A:F Ratio, heat balance sheet for a. Four stroke Diesel Engine b. Four stroke Petrol Engine c. Multi Cylinder Diesel/Petrol Engine, (Morse test) d. Two stroke Petrol Engine Variable Compression Ratio I.C. Engine.
7	Measurements of Exhaust Emissions of Petrol engine.
8	Measurements of Exhaust Emissions of Diesel engine.
	PART C (OPTIONAL)
9	Visit to Automobile Industry/service stations.
10	Demonstration of $p\theta$, pV plots using Computerized IC engine test rig

Course Outcomes: At the end of the course, the student will be able to:

CO1: Perform experiments to determine the properties of fuels and oils.

CO2: Conduct experiments on engines and draw characteristics.

CO3: Test basic performance parameters of I.C. Engine and implement the knowledge in industry.

CO4: Identify exhaust emission, factors affecting them and exhibit his competency towards preventive maintenance of IC engines.

Scheme of Examination:

ONE question from part A:	30 Marks
ONE question from part B:	50 Marks
Viva –Voice :	20 Marks
Total :	100 Marks

B. E. MECHANICAL ENGINEEING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – V

ENVIRONMENTAL STUDIES

Course Code	**18CIV59**	CIE Marks	40
Teaching Hours / Week (L:T:P)	(1:0:0)	SEE Marks	60
Credits	01	Exam Hours	02

Module - 1

Ecosystems (Structure and Function): Forest, Desert, Wetlands, Riverine, Oceanic and Lake. 02 Hrs
Biodiversity: Types, Value; Hot-spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.

Module - 2

Advances in Energy Systems (Merits, Demerits, Global Status and Applications)**:** Hydrogen, Solar, OTEC, Tidal and Wind. 02 Hrs
Natural Resource Management (Concept and case-studies): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading.

Module - 3

Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies)**:** Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution.02 Hrs
Waste Management & Public Health Aspects: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.

Module - 4

Global Environmental Concerns (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.

Module - 5

Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications): G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship- NGOs. 03 Hrs
Field work: Visit to an Environmental Engineering Laboratory or Green Building or Water Treatment Plant or Waste water treatment Plant; ought to be Followed by understanding of process and its brief documentation.

Course Outcomes: At the end of the course, students will be able to:

- CO1: Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale,
- CO2: Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
- CO3: Demonstrate ecology knowledge of a complex relationship between biotic and abiotic components.
- CO4: Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.

Question paper pattern:

- The Question paper will have 100 objective questions.
- Each question will be for 01 marks
- Student will have to answer all the questions in an OMR Sheet.
- The Duration of Exam will be 2 hours.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Environmental Studies	Benny Joseph	Tata Mc Graw – Hill.	2nd Edition, 2012

2.	Environmental Studies	S M Prakash	Pristine Publishing House, Mangalore	3rd Edition, 2018
3	Environmental Studies – From Crisis to Cure	R Rajagopalan	Oxford Publisher	2005
Reference Books				
1	Principals of Environmental Science and Engineering	Raman Sivakumar	Cengage learning, Singapur.	2nd Edition, 2005
2	Environmental Science – working with the Earth	G.Tyler Miller Jr.	Thomson Brooks /Cole,	11th Edition, 2006
3	Text Book of Environmental and Ecology	Pratiba Sing, AnoopSingh& Piyush Malaviya	Acme Learning Pvt. Ltd. New Delhi.	1st Edition

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B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

FINITE ELEMENT METHODS

Course Code	**18ME61**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

- To learn the basic principles of finite element analysis procedure
- To understand the design and heat transfer problems with application of FEM.
- Solve 1 D, 2 D and dynamic problems using Finite Element Analysis approach.
- To learn the theory and characteristics of finite elements that represent engineering structures.
- To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses.

Module-1

Introduction to Finite Element Method: General steps of the finite element method. Engineering applications of finite element method. Advantages of the Finite Element Method.

Boundary conditions: Homogeneous and non-homogeneous for structural, heat transfer and fluid flow problems. Potential energy method, Rayleigh Ritz method, Galerkin's method, Displacement method of finite element formulation. Convergence criteria, Discretisation process, **Types of elements:** 1D, 2D and 3D, Node numbering, Location of nodes. **Strain-** displacement relations, Stress-strain relations, Plain stress and Plain strain conditions, temperature effects.

Interpolation models: Simplex, complex and multiplex elements, linear interpolation polynomials in terms of global coordinates 1D, 2D, 3D Simplex Elements.

Module-2

Introduction to the stiffness (Displacement) method: Introduction, Derivation of stiffness matrix, Derivation of stiffness matrix for a spring element, Assembly the total stiffness matrix by superposition. One-Dimensional Elements-Analysis of Bars and Trusses, Linear interpolation polynomials in terms of local coordinate's for1D, 2Delements. Higher order interpolation functions for 1D quadratic and cubic elements in natural coordinates, , , Constant strain triangle, Four-Nodded Tetrahedral Element (TET 4), Eight-Nodded Hexahedral Element (HEXA 3 8), 2D iso-parametric element, Lagrange interpolation functions.

Numerical integration: Gaussian quadrature one point, two point formulae, 2D integrals. Force terms: Body force, traction force and point loads, Numerical Problems: Solution for displacement, stress and strain in 1D straight bars, stepped bars and tapered bars using elimination approach and penalty approach, Analysis of

Module-3

Beams and Shafts: Boundary conditions, Load vector, Hermite shape functions, Beam stiffness matrix based on Euler-Bernoulli beam theory, Examples on cantilever beams, propped cantilever beams, Numerical problems on simply supported, fixed straight and stepped beams using direct stiffness method with concentrated and uniformly distributed load.

Torsion of Shafts: Finite element formulation of shafts, determination of stress and twists in circular shafts.

Module-4

Heat Transfer: Basic equations of heat transfer: Energy balance equation, Rate equation: conduction, convection, radiation, 1D finite element formulation using vibration method, Problems with temperature gradient and heat fluxes, heat transfer in composite sections, straight fins.

Fluid Flow: Flow through a porous medium, Flow through pipes of uniform and stepped sections, Flow through hydraulic net works.

Module-5

Axi-symmetric Solid Elements: Derivation of stiffness matrix of axisymmetric bodies with triangular elements, Numerical solution of axisymmetric triangular element(s) subjected to surface forces, point loads, angular velocity, pressure vessels.
Dynamic Considerations: Formulation for point mass and distributed masses, Consistent element mass matrix of one dimensional bar element, truss element, axisymmetric triangular element, quadrilateral element, beam element. Lumped mass matrix of bar element, truss element, Evaluation of eigen values and eigen vectors, Applications to bars, stepped bars, and beams.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Identify the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements.

CO2: Develop element characteristic equation and generation of global equation.

CO3: Formulate and solve Axi-symmetric and heat transfer problems.

CO4: Apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axi-symmetric and dynamic problems

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	A first course in the Finite Element Method	Logan, D. L	Cengage Learning	6th Edition 2016
2	Finite Element Method in Engineering	Rao, S. S	Pergaman Int. Library of Science	5th Edition 2010
3	Finite Elements in Engineering	Chandrupatla T. R	PHI	2nd Edition 2013
Reference Books				
1	Finite Element Method	J.N.Reddy	McGraw -Hill International Edition	
2	Finite Elements Procedures	Bathe K. J	PHI	
3	Concepts and Application of Finite Elements Analysis	Cook R. D., et al.	Wiley & Sons	4th Edition 2003

E- Learning

- VTU, E- learning

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

DESIGN OF MACHINE ELEMENTS II

Course Code	**18ME62**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

- To understand various elements involved in a mechanical system.
- To analyze various forces acting on the elements of a mechanical system and design them using appropriate techniques, codes, and standards.
- To select transmission elements like gears, belts, pulleys, bearings from the manufacturers' catalogue.
- To design a mechanical system integrating machine elements.
- To produce assembly and working drawings of various mechanical systems involving machine elements like belts, pulleys, gears, springs, bearings, clutches and brakes.

Module-1

Springs: Types of springs, spring materials, stresses in helical coil springs of circular and non-circular cross sections. Tension and compression springs, concentric springs; springs under fluctuating loads.
Leaf Springs: Stresses in leaf springs, equalized stresses, and nipping of leaf springs.
Introduction to torsion and Belleville springs.
Belts: Materials of construction of flat and V belts, power rating of belts, concept of slip and creep, initial tension, effect of centrifugal tension, maximum power condition.
Selection of flat and V belts- length & cross section from manufacturers' catalogues. Construction and application of timing belts.
Wire ropes: Construction of wire ropes, stresses in wire ropes, and selection of wire ropes.

Module-2

Gear drives: Classification of gears, materials for gears, standard systems of gear tooth, lubrication of gears, and gear tooth failure modes.
Spur Gears: Definitions, stresses in gear tooth: Lewis equation and form factor, design for strength, dynamic load and wear.
Helical Gears: Definitions, transverse and normal module, formative number of teeth, design based on strength, dynamic load and wear.

Module-3

Bevel Gears: Definitions, formative number of teeth, design based on strength, dynamic load and wear.
Worm Gears: Definitions, types of worm and worm gears, and materials for worm and worm wheel. Design based on strength, dynamic, wear loads and efficiency of worm gear drives.

Module-4

Design of Clutches: Necessity of a clutch in an automobile, types of clutch, friction materials and its properties. Design of single plate, multi-plate and cone clutches based on uniform pressure and uniform wear theories.
Design of Brakes: Different types of brakes, Concept of self-energizing and self-locking of brakes. Practical examples, Design of band brakes, block brakes and internal expanding brakes.

Module-5

Lubrication and Bearings: Lubricants and their properties, bearing materials and properties; mechanisms of lubrication, hydrodynamic lubrication, pressure development in oil film, bearing modulus, coefficient of friction, minimum oil film thickness, heat generated, and heat dissipated. Numerical examples on hydrodynamic journal and thrust bearing design.

Antifriction bearings: Types of rolling contact bearings and their applications, static and dynamic load carrying capacities, equivalent bearing load, load life relationship; selection of deep grove ball bearings from the manufacturers' catalogue; selection of bearings subjected to cyclic loads and speeds;probability of survival.

Assignment:

Course work includes a **Design project**. Design project should enable the students to design a mechanical system (like single stage reduction gear box with spur gears, single stage worm reduction gear box, V-belt and pulley drive system, machine tool spindle with bearing mounting, C-clamp, screw jack, etc.) A group of students (maximum number in a group should be 4) should submit assembly drawing and part drawings, completely dimensioned, indicating the necessary manufacturing tolerances, surface finish symbols and geometric tolerances wherever necessary. Design project must be completed using appropriate solid modeling software. Computer generated drawings must be submitted. Design calculations must be hand written and should be included in the report. Design project should be given due credit in internal assessment.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Apply design principles for the design of mechanical systems involving springs, belts, pulleys, and wire ropes.
CO2: Design different types of gears and simple gear boxes for relevant applications.
CO3: Understand the design principles of brakes and clutches.
CO4: Apply design concepts of hydrodynamic bearings for different applications and select Anti friction bearings for different applications using the manufacturers, catalogue.
CO6: Apply engineering design tools to product design.
CO7: Become good design engineers through learning the art of working in a team.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Shigley's Mechanical Engineering Design	Richard G. Budynas,and J. Keith Nisbett	McGraw-Hill Education	10th Edition, 2015
2	Fundamentals of Machine Component Design	Juvinall R.C, and Marshek K.M	John Wiley & Sons	Third Edition 2007 Wiley student edition
3	Design of Machine Elements	V. B. Bhandari	Tata Mcgraw Hill	4th Ed 2016.
4	Design of Machine Elements-II	Dr.M H Annaiah Dr. J Suresh Kumar Dr.C N Chandrappa	New Age International (P) Ltd.,	1s Ed., 2016
Reference Books				
1	Machine Design- an integrated approach	Robert L. Norton	Pearson Education	2nd edition
2	Design and Machine Elements	Spotts M.F., ShoupT.E	Pearson Education	8th edition, 2006

3	Machine design Hall, Holowenko, Laughlin (Schaum's Outline Series	adapted by S.K.Somani	Tata McGraw Hill Publishing Company Ltd	Special Indian Edition, 2008
4	Elements of Machine Design	H.G.Patil, S.C.Pilli, R.R.Malagi, M.S.Patil	IK International	First edition,2019
5	Design of Machine ElementsVolume II	T. Krishna Rao	IK international publishing house	2013
6	Hand book of Mechanical Design	G. M. Maithra and L.V.Prasad	Tata McGraw Hill	2nd edition,2004

Design Data Hand Books:

[1] Design Data Hand Book, K.Lingaiah, McGraw Hill, 2nd edition, 2003.
[2] Design Data Hand Book, K.Mahadevan and Balaveera Reddy, CBS publication.
[3] Design Data Hand Book, H.G.Patil, I.K.International Publisher, 2010
[4] PSG Design Data Hand Book, PSG College of technology, Coimbatore.

B. E. MECHANICAL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VI			
HEAT TRANSFER			
Course Code	**18ME63**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

- Study the modes of heat transfer.
- Learn how to formulate and solve 1-D steady and unsteady heat conduction problems.
- Apply empirical correlations for fully-developed laminar, turbulent internal flows and external boundary layer convective flow problems.
- Study the basic principles of heat exchanger analysis and thermal design.
- Understand the principles of boiling and condensation including radiation heat transfer related engineering problems.

Module-1

Introductory concepts and definitions: Modes of heat transfer: Basic laws governing conduction, convection, and radiation heat transfer; Types of boundary conditions. General three dimensional Heat Conduction Equation: Derivation of the equation in (i) Cartesian, coordinate only. Discussion of three dimensional Heat Conduction Equation in (ii) Polar and (iii) Spherical Co-ordinate Systems.

Steady-state one-dimensional heat conduction problems in Cartesian System: Steady-state one-dimensional heat conduction problems (i) without heat generation and (ii) constant thermal conductivity - in Cartesian system with various possible boundary conditions. Brief Introduction to variable thermal conductivity and heat generation [No numerical on variable thermal conductivity and heat generation] Thermal Resistances in Series and in Parallel. Critical Thickness of Insulation in cylinder and spheres Concept. Derivation

Module-2

Extended Surfaces or Fins: Classification, Straight Rectangular and Circular Fins, Temperature Distribution and Heat Transfer Calculations, Fin Efficiency and Effectiveness, Applications

Transient [Unsteady-state] heat conduction: Definition, Different cases - Negligible internal thermal resistance, negligible surface resistance, comparable internal thermal and surface resistance, Lumped body, Infinite Body and Semi-infinite Body, Numerical Problems, Heisler and Grober charts.

Module-3

Numerical Analysis of Heat Conduction: Introduction, one-dimensional steady conduction and one dimensional unsteady conduction, boundary conditions, solution methods.

Thermal Radiation: Fundamental principles - Gray, White, Opaque, Transparent and Black bodies, Spectral emissive power, Wien's displacement law, Planck's laws, Hemispherical Emissive Power, Stefan-Boltzmann law for the total emissive power of a black body, Emissivity and Kirchhoff's Laws, View factor, Net radiation exchange between parallel plates, concentric cylinders, and concentric spheres, Radiation Shield.

Module-4

Forced Convection: Boundary Layer Theory, Velocity and Thermal Boundary Layers, Prandtl number, Turbulent flow, Various empirical solutions, Forced convection flow over cylinders and spheres, Internal flows –laminar and turbulent flow solutions.

Free convection: Laminar and Turbulent flows, Vertical Plates, Vertical Tubes and Horizontal Tubes, Empirical solutions.

Module-5

Heat Exchangers: Definition, Classification, applications, LMTD method, Effectiveness - NTU method, Analytical Methods, Fouling Factors, Chart Solution Procedures for solving Heat Exchanger problems: Correction Factor Charts and Effectiveness-NTU Charts.

Introduction to boiling: pool boiling, Bubble Growth Mechanisms, Nucleate Pool Boiling, Critical Heat Flux in Nucleate Pool Boiling, Pool Film Boiling, Critical Heat Flux, Heat Transfer beyond the Critical Point, filmwise and dropwise Condensation.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand the modes of heat transfer and apply the basic laws to formulate engineering systems.

CO2: Understand and apply the basic laws of heat transfer to extended surface, composite material and unsteady state heat transfer problems.

CO3: Analyze heat conduction through numerical methods and apply the fundamental principle to solve radiation heat transfer problems.

CO4: Analyze heat transfer due to free and forced convective heat transfer.

CO5: Understand the design and performance analysis of heat exchangers and their practical applications, Condensation and Boiling phenomena.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Principals of heat transfer	Frank Kreith, Raj M. Manglik, Mark S. Bohn	Cengage learning	Seventh Edition 2011.
2	Heat transfer, a practical approach	Yunus A. Cengel	Tata Mc Graw Hill	Fifth edition
Reference Books				
1	Heat and mass transfer	Kurt C, Rolle	Cengage learning	second edition
2	Heat Transfer A Basic Approach	M. NecatiOzisik	McGraw Hill, New York	2005
3	Fundamentals of Heat and Mass Transfer	Incropera, F. P. and De Witt, D. P	John Wiley and Sons, New York	5th Edition 2006
4	Heat Transfer	Holman, J. P.	Tata McGraw Hill, New York	9th Edition 2008

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B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VI
Professional Elective- 1

NON-TRADITIONAL MACHINING

Course Code	**18ME641**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To learn various concepts related to modern machining processes & their applications.
- To appreciate the differences between conventional and non-conventional machining processes.
- To acquire a functional understanding of non-traditional manufacturing equipment.
- To know about various process parameters and their influence on performance and their applications.
- To impart knowledge on various types of energy involved in non-traditional machining processes.

Module-1

Introduction to Non-traditional machining, Need for Non-traditional machining process, Comparison between traditional and non-traditional machining, general classification Non-traditional machining processes, classification based on nature of energy employed in machining, selection of non-traditional machining processes, Specific advantages, limitations and applications of non-traditional machining processes.

Module-2

Ultrasonic Machining (USM): Introduction, Equipment and material process, Effect of process parameters: Effect of amplitude and frequency, Effect of abrasive grain diameter, effect of slurry, tool & work material. Process characteristics: Material removal rate, tool wear, accuracy, surface finish, applications, advantages & limitations of USM.

Abrasive Jet Machining (AJM): Introduction, Equipment and process of material removal, process variables: carrier gas, type of abrasive, work material, stand-off distance (SOD). Process characteristics-Material removal rate, Nozzle wear, accuracy & surface finish. Applications, advantages & limitations of AJM.

Module-3

ELECTROCHEMICAL MACHINING (ECM): Introduction, Principle of electro chemical machining, ECM equipment, elements of ECM operation, Chemistry of ECM. ECM Process characteristics: Material removal rate, accuracy, surface finish. Process parameters: Current density, Tool feed rate, Gap between tool & work piece, velocity of electrolyte flow, type of electrolyte, its concentration temperature, and choice of electrolytes. ECM Tooling: ECM tooling technique & example, Tool & insulation materials. Applications ECM: Electrochemical grinding and electrochemical honing process. Advantages, disadvantages and application of ECG, ECH.

CHEMICAL MACHINING (CHM): Elements of the process, Resists (maskants), Etchants. Types of chemical machining process-chemical blanking process, chemical milling process. Process characteristics of CHM: material removal rate, accuracy, surface finish, advantages, limitations and applications of chemical machining process.

Module-4

ELECTRICAL DISCHARGE MACHINING (EDM): Introduction, mechanism of metal removal, EDM equipment: spark erosion generator (relaxation type), dielectric medium-its functions & desirable properties, electrode feed control system. Flushing types; pressure flushing, suction flushing, side flushing, pulsed flushing. EDM process parameters: Spark frequency, current & spark gap, surface finish, Heat Affected Zone. Advantages, limitations & applications of EDM, Electrical discharge grinding, Traveling wire EDM.

PLASMA ARC MACHINING (PAM): Introduction, non-thermal generation of plasma, equipment mechanism of metal removal, Plasma torch, process parameters, process characteristics. Safety precautions. Safety precautions, applications, advantages and limitations.

Module-5

LASER BEAM MACHINING (LBM): Introduction, generation of LASER, Equipment and mechanism of metal removal, LBM parameters and characteristics, Applications, Advantages & limitations.
ELECTRON BEAM MACHINING (EBM): Introduction, Principle, equipment and mechanism of metal removal, applications, advantages and limitations.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand the compare traditional and non-traditional machining process and recognize the need for Non- traditional machining process.

CO2: Understand the constructional features, performance parameters, process characteristics, applications, advantages and limitations of USM, AJM and WJM.

CO3: Identify the need of Chemical and electro-chemical machining process along with the constructional features, process parameters, process characteristics, applications, advantages and limitations.

CO4: Understand the constructional feature of the equipment, process parameters, process characteristics, applications, advantages and limitations EDM & PAM.

CO5: Understand the LBM equipment, LBM parameters, and characteristics. EBM equipment and mechanism of metal removal, applications, advantages and limitations LBM & EBM.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Modern Machining Process	by P.C Pandey and H S Shah	McGraw Hill Education India Pvt. Ltd.	2000
2	Production technology	HMT	McGraw Hill Education India Pvt. Ltd	2001
Reference Books				
1	New Technology	Dr. Amitabha Bhattacharyya	The Institute of Engineers (India)	2000
2	Modern Machining process	Aditya		2002

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B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VI
Professional Elective- 1

REFRIGERATION AND AIR CONDITIONING

Course Code	**18ME642**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- Study the basic definition, ASHRAE Nomenclature for refrigerating systems.
- Understand the working principles and applications of different types of refrigeration systems.
- Study the working of air conditioning systems and their applications.
- Identify the performance parameters and their relations of an air conditioning system.

Module-1

Introduction to Refrigeration –Basic Definitions, ASHRAE Nomenclature, Air Refrigeration Cycles-reversed Carnot cycle, Bell-Coleman cycle analysis, Air Refrigeration systems-merits and demerits and applications: Aircraft refrigeration cycles, Joule Thompson coefficient and Inversion Temperature, Linde, Claude and Stirling cycles for liquefaction of air.

Industrial Refrigeration-Chemical and process industries, Dairy plants , Petroleum refineries, Food processing and food chain, Miscellaneous

Module-2

Vapour Compression Refrigeration System(VCRS): Comparison of Vapour Compression Cycle and Gas cycle, Vapour Compression Refrigeration system Working and analysis, Limitations, Superheat horn and throttling loss for various refrigerants, efficiency, Modifications to standard cycle – liquid-suction heat exchangers, Grindlay cycle and Lorenz cycle, Optimum suction condition for optimum COP Actual cycles with pressure drops, Complete Vapour Compression Refrigeration System, Multi-Pressure, Multi-evaporator systems or Compound Vapour Compression Refrigeration Systems – Methods like Flash Gas removal, Flash inter cooling and water Inter cooling.

Module-3

Vapour Absorption Refrigeration Systems: Absorbent – Refrigerant combinations, Water-Ammonia Systems,Practical problems, Lithium- Bromide System, Contrast between the two systems, Modified Version of Aqua-Ammonia System with Rectifier and Analyzer Assembly.Practical problems – crystallization and air leakage, Commercial systems

Other types of Refrigeration systems: Brief Discussion on (i) Steam-Jet refrigeration system and (ii) Thermoelectric refrigeration, pulse tube refrigeration, thermoacoustic refrigeration systems

Module-4

Refrigerants: Primary and secondary refrigerants, Designation of Refrigerants, Desirable properties of refrigerants including solubility in water and lubricating oil, material compatibility, toxicity, flammability, leak detection, cost, environment and performance issues Thermodynamic properties of refrigerants, Synthetic and natural refrigerants, Comparison between different refrigerants vis a vis applications, Special issues and practical implications Refrigerant mixtures – zeotropic and azeotropic mixtures

Refrigeration systems Equipment: Compressors, Condensers, Expansion Devices and Evaporators, A brief look at other components of the system.

Module-5

Air-Conditioning: Introduction to Air-Conditioning, Basic Definition, Classification, power rating, Mathematical Analysis of Air-Conditioning Loads, Related Aspects, Different Air-Conditioning Systems-Central – Station Air-Conditioning System, Unitary Air-Conditioning System, Window Air-Conditioner and Packaged Air-Conditioner, Components related to Air-Conditioning Systems.

Transport air conditioning Systems:Air conditioning systems for automobiles (cars, buses etc.), Air conditioning systems for trains, Air conditioning systems for ships

Course Outcomes: At the end of the course, the student will be able to:
CO1: Illustrate the principles, nomenclature and applications of refrigeration systems.
CO2: Explain vapour compression refrigeration system and identify methods for performance improvement
CO3: Study the working principles of air, vapour absorption, thermoelectric and steam-jet and thermoacoustic refrigeration systems.
CO4: Estimate the performance of air-conditioning systems using the principles of psychrometry.
CO5: Compute and Interpret cooling and heating loads in an air-conditioning system.
CO6: Identify suitable refrigerant for various refrigerating systems.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Refrigeration and Air-conditioning	Arora C.P	Tata Mc Graw –Hill, New Delhi	2nd Edition, 2001
2	Principles of Refrigeration	Roy J. Dossat	Wiley Limited	
3	Refrigeration and Air-conditioning	Stoecker W.F., and Jones J.W.,	Mc Graw - Hill, New Delhi	2nd edition, 1982.
Reference Books				
1	Heating, Ventilation and Air Conditioning	McQuistion	Wiley Students edition	5th edition2000.
2	Air conditioning	PITA	Pearson	4th edition 2005
3	Refrigeration and Air-Conditioning	S C Arora& S Domkundwar	Dhanpat Rai Publication	
4	Principles of Refrigeration	Dossat	Pearson	2006
5	Refrigeration and Air-Conditioning	Manohar prasad		
6	Handbook of Air Conditioning and Refrigeration	Shan K. Wang	McGraw-Hill Education	2/e,2001

Data Book:

1. Mathur M.L. & Mehta,Refrigerant and Psychrometric Properties (Tables & Charts) SI Units, F.S., Jain Brothers,2008

E- Learning

- http://nptel.ac.in/courses/112105128/#

E-Resources

- VTU, E- learning, MOOCS, Open courseware

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VI
Professional Elective- 1

THEORY OF ELASTICITY

Course Code	**18ME643**	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To provide the student with the mathematical and physical principles of Theory of Elasticity.
- To provide the student with various solution strategies while applying them to practical cases.

Module-1

Analysis of Stress: Definition and notation of stress, Equations of equilibrium in differential form, Stress components on an arbitrary plane, Equality of cross shear, Stress invariants, Principal stresses, Octahedral stress, Planes of maximum shear, Stress transformation, Plane state of stress, Mohr's diagram for 3dimensional state of stress.

Module-2

Analysis of Strain: Displacement field, Strains in term of displacement field, Infinitesimal strain at a point, Engineering shear strains, Strain invariants, Principal strains, Octahedral strains, Plane state of strain, Compatibility equations, Strain transformation. Principle of super position, Saint Venant principle.

Module-3

Two-Dimensional classical elasticity: Cartesian co-ordinates, Relation between plane stress and plane strain, stress functions for plane stress and plane strain state, Airy's stress functions, investigation of Airy's stress function for simple beams. Bending of a narrow cantilever beam of rectangular cross section under edge load. Bending of simply supported beam under UDL, stress concentration, stress distribution in an infinite plate with a circular hole subjected to uniaxial and biaxial loads.
General equations in polar coordinates, stress distribution symmetrical about an axis, Thick wall cylinder subjected to internal and external pressures.

Module-4

Stress analysis in Axisymmetric body: Stresses in rotating discs of uniform thickness and cylinders. Numerical Problems.
Torsion: Torsion of circular, elliptical and triangular bars, Prandtl's membrane analogy, Torsion of thin walled thin tubes, Torsion of thin walled multiple cell closed sections.

Module-5

Thermal stress: Thermo elastic stress strain relations, equations of equilibrium, thermal stresses in thin circular discs and in long circular cylinders.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand the Basic field equations of linear elastic solids, force, stress, strain and equilibrium in solids.

CO2: Analyse the 2D structural elements, beams, cylinders.

CO3: Use analytical techniques to predict deformation, internal force and failure of simple solids and structural components.

CO4: Analyse the axisymmetric structural elements.

CO5: Analyse the structural members subjected to torsion

CO6: Determine the thermal stresses in plain stress and plane stain conditions.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Theory of Elasticity	S. P. Timoshenko and J. N Gordier	Mc-Graw Hill International	3rd edition, 2010
2	Advanced Mechanics of solids	L. S. Srinath	Tata Mc. Graw Hill	2009
Reference Books				
1	Theory of Elasticity	Sadhu Singh	Khanna Publications	2004
2	Applied Elasticity	T.G. Seetharamuand Govindaraju	Interline Publishing	2008.

B. E. MECHANICAL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER – VI Professional Elective- 1			
VIBRATIONS AND NOISE ENGINEERING			
Course Code	**18ME644**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To enable the students to understand the theoretical principles of vibration and vibration analysis techniques for the practical solution of vibration problems.
- To enable the students to understand the importance of vibrations in mechanical design of machine parts subject to vibrations
- To make free and forced (harmonic, periodic, non-periodic) vibration analysis of single and multi-degree of freedom linear systems.
- Be able to write the differential equation of motion of vibratory systems.

Module-1

Forced vibrations (1DOF): Introduction, analysis of forced vibration with constant harmonic excitation, MF, rotating and reciprocating unbalances, excitation of support (Relative and absolute amplitudes), force and motion transmissibility, energy dissipated due to damping and numerical problems.

Systems with 2DOF: Principal modes of vibrations, normal mode and natural frequencies of systems (Damping is not included), simple spring-mass systems, masses on tightly stretched strings, double pendulum, tensional systems, combined rectilinear and angular systems, geared systems and numerical problems.

Module-2

Numerical methods for multi DOF systems: Maxwell's reciprocal theorem, influence coefficients, Rayleigh's method, Dunkerley's method, stodola method, orthogonality principle, method of matrix iteration and numerical.

Modal analysis and condition monitoring: signal analysis, dynamic testing of machines and structures,

Module-3

Vibration measuring instruments and whirling of shafts: seismic instruments, vibrometers, accelerometer, frequency measuring instruments and numerical. Whirling of shafts with and without damping.

Vibration Control: Introduction, Vibration isolation theory, Vibration isolation and motion isolation for harmonic excitation, practical aspects of vibration analysis, vibration isolation, Dynamic vibration absorbers and Vibration dampers.

Module-4

Transient Vibration of single Degree-of freedom systems: Impulse excitation, arbitrary excitation, Laplace transforms formulation, Pulse excitation and rise time, Shock response spectrum, Shock isolation.

Noise Engineering: Subjective response of sound: Frequency and sound dependent human response; the decibel scale; relationship between , sound pressure level(SPL), sound power level and sound intensity scale; relationship between addition, subtraction and averaging, sound spectra and Octave band analysis ; loudness; weighting networks; equivalent sound level, auditory effects of noise; hazardous noise, exposure due to machines and equipment; hearing conservation and damage risk criteria, daily noise doze.

Module-5

Noise: Sources, Isolation and control: Major sources of noise on road and in industries, noise due to construction equipment and domestic appliances, industrial noise control, strategies-noise control at source (with or without sound enclosures), noise control along the path (with or without partitions and acoustic barriers); noise control at the receiver, ear defenders, earplugs, semi-insert protectors.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Characterize the single and multi-degrees of freedom systems subjected to free and forced vibrations with and without damping.

CO2: Apply the method of vibration measurements and its controlling.

CO3: Determine vibratory responses of SDOF and MDOF systems to harmonic, periodic and non-periodic excitation.

CO4: Analyze the mathematical model of a linear vibratory system to determine its response.

CO5: Obtain linear mathematical models of reallife engineering systems.

CO6: Apply the principles of vibration and noise reduction techniques to real life engineering problems.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Mechanical Vibrations	S. S. Rao	Pearson Education	
2	Fundamentals of Mechanical Vibration	S. Graham Kelly	McGraw-Hill	
3	Mechanical Vibrations	W.T. Thomson	Prentice Hill India	
4	Vibraitons and Acoustics – Measurements and signal	C Sujatha	Tata McGraw Hill	
Reference Books				
1	Mechanical Vibrations	G. K. Grover	Nem Chand and Bros.	
2	Theory of Vibration with Application	William T. Thomson, Marie Dillon Dahleh, Chandramouli	Pearson Education	5th edition
3	Mechanical Vibrations	V. P. Singh	Dhanpat Rai & Company	
4	Mechanical Vibrations and Noise engineering	Amberkar A.G.	PHI	

E- Learning

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B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VI
Professional Elective- 1

COMPOSITE MATERIALS TECHNOLOGY

Course Code	**18ME645**	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To know the behaviour of constituents in the composite materials
- To Enlighten the students in different types of reinforcement
- To Enlighten the students in different types of matrices
- To develop the student's skills in understanding the different manufacturing methods available for composite material.
- To understand the various characterization techniques
- To illuminate the knowledge and analysis skills in applying basic laws in mechanics to the composite materials.

Module-1

Introduction to Composite Materials: Definition, classification & brief history of composite materials.
Constituent of composite materials: Reinforcements, Matrix, Coupling agents, coatings & fillers.
Reinforcements: Introduction, Glass Fibers, Boron Fibers, Carbon Fibers, Organic Fibers, Ceramic Fibers, Whiskers, Other Non-oxide Reinforcements, Comparison of Fibers
Matrix Materials: Polymers, Metals and Ceramic Matrix Materials.
Interfaces: Wettability, Crystallographic nature of interface, types of bonding at the interface and optimum interfacial bond strength.

Module-2

Polymer Matrix Composites (PMC): Processing of PMC's; Processing of Thermoset Matrix Composites, Thermoplastic Matrix Composites, Sheet Moulding Compound and carbon reinforced polymer composites. Interfaces in PMC's, Structure & Properties of PMC's, applications
Metal Matrix Composites: Types of metal matrix composites, Important Metallic Matrices, Processing, Interfaces in Metal Matrix Composites, Properties & Applications.

Module-3

Ceramic Matrix Composites (CMC): Processing of CMC's; Cold Pressing & Sintering, Hot Pressing, Reaction Bonding Processes, Infiltration, Directed Oxidation, In Situ Chemical Reaction Technique, Sol-Gel, Polymer Infiltration & Pyrolysis, Electrophoretic Deposition, Self-Propagating High Temperature Synthesis. Interfaces, properties and applications of CMC's.
Carbon Fiber/Carbon Matrix Composites: Processing of Carbon/Carbon Composites, Oxidation protection of Carbon/Carbon Composites, Properties of Carbon/Carbon Composites, and application of Carbon/Carbon Composites.
Multi-filamentary Superconducting Composites: The Problem of Flux Pinning, Types of Super Conductor, Processing & structure of Multi filamentary superconducting composites. Applications of multi-filamentary superconducting composites.

Module-4

Nonconventional Composites: Introduction, **Nanocomposites;** Polymer clay nanocomposites, self healing composites, self-reinforced composites. Biocomposites, **Laminates;** Ceramic Laminates, Hybrid Composites.
Performance/Characterization of Composites: Static Mechanical Properties; Tensile Properties, Compressive Properties, Flexural Properties, In-Plane Shear Properties, Interlaminar Shear Strength.
Fatigue Properties; Tension–Tension Fatigue, Flexural Fatigue. **Impact Properties;** Charpy, Izod, and Drop-Weight Impact Test.

Module-5

Micromechanics of Composites: Density, Mechanical Properties**;** Prediction of Elastic Constants, Micromechanical Approaches, Halpin-Tsai Equations, Transverse Stresses, Thermal properties. Numerical Problems.

Macromechanics of Composites: Introduction, Elastic constants of an isotropic material, elastic constants of a lamina, relationship between engineering constants and reduced stiffnesses and compliances.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Use different types of manufacturing processes in the preparation of composite materials

CO2: Analyze the problems on macro mechanical 88ehavior of composites

CO3: Analyze the problems on micromechanical 88ehavior of Composites

CO4: Determine stresses and strains relation in composites materials.

CO5: Understand and effective use of properties in design of composite structures

CO6: Perform literature search on a selected advanced material topic.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Composite Material Science and Engineering	Krishan K. Chawla	Springer	Third Edition First Indian Reprint 2015
2	Fibre-Reinforced Composites, Materials, Manufacturing, and Design	P.K. Mallick	CRC Press, Taylor & Francis Group	Third Edition
3	Mechanics of Composite Materials & Structures	MadhijitMukhopadhay	Universities Press	2004
Reference Books				
1	Mechanics of Composite materials	Autar K. Kaw	CRC Taylor & Francis	2nd Ed, 2005
2	Stress analysis of fiber Reinforced Composites Materials	Michael W, Hyer	Mc-Graw Hill International	2009
3	Mechanics of Composite Materials	.Robert M. Jones	Taylor & Francis	1999

E- Learning

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B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VI
Professional Elective- 1

ENTREPRENEURSHIP DEVELOPMENT

Course Code	**18ME646**	**CIE Marks**	**40**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**60**
Credits	**03**	**Exam Hours**	**03**

Course Learning Objectives:

- To enable the students to understand the concept of Entrepreneur and Entrepreneurship and relevant roles
- To enable the students to learn creativity and entrepreneurial plan including Project Feasibility and Project Appraisal
- To enable the students to understand Corporate entrepreneurship and issues related to Corporate entrepreneurship
- To enable the students to understand Family and Non Family Entrepreneur & Women entrepreneurs and women entrepreneurs in India
- To enable the students to understand International Entrepreneurship Opportunities and Case studies on Indian Start ups

Module-1

Entrepreneurship: Definition of Entrepreneur, Internal and External Factors, Functions of an Entrepreneur, Entrepreneurial motivation and Barriers, Classification of Entrepreneurship, Theory of Entrepreneurship, Concept of Entrepreneurship, Development of entrepreneurship; Concept of entrepreneur ,Manager and Intraprenuer(differences in their roles, responsibilities and Career Opportunities)

Module-2

Creativity and Entrepreneurial Plan: The business plan as an entrepreneurial tool, Contents of a business plan, Idea Generation, Screening and Project Identification, Creative Performance, Feasibility Analysis: Economic, Marketing, Financial and Technical; Project Planning: Evaluation, Monitoring and Control segmentation. Creative Problem Solving: Heuristics, Brainstorming, Synectics, Value Analysis, Innovation. Project Feasibility and Project Appraisal.

Module-3

Corporate entrepreneurship: Introduction, Flavors of corporate entrepreneurship, Corporate venturing, Intrapreneurship, organizational transformation, Industry rule bending, Need for corporate entrepreneurship, domain of corporate entrepreneurship, conditions favorable for Corporate entrepreneurship, benefits of Corporate entrepreneurship, issues related to Corporate entrepreneurship.

Module-4

Family and Non Family Entrepreneur & Women entrepreneurs: Role of Professionals, Professionalism vs family entrepreneurs, Role of Woman entrepreneur, , Factors influencing women entrepreneur, Challenges for women entrepreneurs, Growth and development of women entrepreneurs in India

Module-5

International Entrepreneurship Opportunities: The nature of international entrepreneurship, Importance of international business to the firm, International versus domestics' entrepreneurship, Stages of economic development. Institutional support for new ventures: Supporting Organizations; Incentives and facilities; Financial Institutions and Small scale Industries, Govt. Policies for SSIs. Case studies on Indian Start ups

Course outcomes:

At the end of the course the student will be able to:

1. understand the concept of Entrepreneur and Entrepreneurship and relevant roles
2. learn creativity and entrepreneurial plan including Project Feasibility and Project Appraisal
3. understand Corporate entrepreneurship and issues related to Corporate entrepreneurship
4. understand Family and Non Family Entrepreneur & Women entrepreneurs and women entrepreneurs in India
5. understand International Entrepreneurship Opportunities and Case studies on Indian Start ups

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
01	Dynamics of Entrepreneurship Development	Vasant Desai	Himalaya Publication house	2011
02	Entrepreneurship , New Venture Creation	David Holt	Prentice Hall India	1991
03	Entrepreneurial Development	S.S. Khanka	S.Chand& Company Ltd. New Delhi	2013
04	Innovation and Entrepreneurship	Peter F. Drucker	Butterworth-Heinemann	2006

Reference Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
01	Entreprenuership – Theory, Process and Practice	Donald F Kuratko	Cengage Learning	9th Edition, 2014
02	"Entrepreneurship	Rajeev Roy	Oxford University Press	2nd Edition, 2011
03	"Enterprenuership theory at cross roads: paradigms and praxis	Mathew J Manimala	Dream tech,	2 Edition 2005
04	Entrepreneurship	Hisrich R D, Peters M P	Tata McGraw-Hill	8th Edition 2013.

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER –VI
OPEN ELECTIVE A

NON CONVENTIONAL ENERGY SOURCES

Course Code	**18ME651**	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To introduce the concepts of solar energy, its radiation, collection, storage and application.
- To introduce the concepts and applications of Wind energy, Biomass energy, Geothermal energy and Ocean energy as alternative energy sources.
- To explore society's present needs and future energy demands.
- To examine energy sources and systems, including fossil fuels and nuclear energy, and then focus on alternate, renewable energy sources such as solar, biomass (conversions), wind power, geothermal, etc.
- To get exposed to energy conservation methods.

Module-1

Introduction: Energy source, India's production and reserves of commercial energy sources, need for non-conventional energy sources, energy alternatives, solar, thermal, photovoltaic. Water power, wind biomass, ocean temperature difference, tidal and waves, geothermal, tar sands and oil shale, nuclear (Brief descriptions); advantages and disadvantages, comparison (Qualitative and Quantitative).

Solar Radiation: Extra-Terrestrial radiation, spectral distribution of extra terrestrial radiation, solar constant, solar radiation at the earth's surface, beam, diffuse and global radiation, solar radiation data.

Measurement of Solar Radiation: Pyrometer, shading ring pyrheliometer, sunshine recorder, schematic diagrams and principle of working.

Module-2

Solar Radiation Geometry: Flux on a plane surface, latitude, declination angle, surface azimuth angle, hour angle, zenith angle, solar altitude angle expression for the angle between the incident beam and the normal to a plane surface (No derivation) local apparent time. Apparent motion of sum, day length, numerical examples.

Radiation Flux on a Tilted Surface: Beam, diffuse and reflected radiation, expression for flux on a tilted surface (no derivations) numerical examples.

Solar Thermal Conversion: Collection and storage, thermal collection devices, liquid flat plate collectors, solar air heaters concentrating collectors (cylindrical, parabolic, paraboloid) (Quantitative analysis); sensible heat storage, latent heat storage, application of solar energy water heating. Space heating and cooling, active and passive systems, power generation, refrigeration. Distillation (Qualitative analysis) solar pond, principle of

Module-3

Performance Analysis of Liquid Flat Plate Collectors: General description, collector geometry, selective surface (qualitative discussion) basic energy-balance equation, stagnation temperature, transmissivity of the cover system, transmissivity – absorptivity product, numerical examples. The overall loss coefficient, correlation for the top loss coefficient, bottom and side loss coefficient, problems (all correlations to be provided). Temperature distribution between the collector tubes, collector heat removal factor, collector efficiency factor and collector flow factor, mean plate temperature, instantaneous efficiency (all expressions to be provided). Effect of various parameters on the collector performance; collector orientation, selective surface, fluid inlet temperature, number covers, dust.

Photovoltaic Conversion: Description, principle of working and characteristics, application.

Module-4

Wind Energy : Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, wind machines; Types of wind machines and their characteristics, horizontal and vertical axis wind mills, elementary design principles; coefficient of performance of a wind mill rotor, aerodynamic considerations of wind mill design, numerical examples.

Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, limitations.

Ocean Thermal Energy Conversion: Principle of working, Rankine cycle, OTEC power stations in the world, problems associated with OTEC.

Module-5

Geothermal Energy Conversion: Principle of working, types of geothermal station with schematic diagram, geothermal plants in the world, problems associated with geothermal conversion, scope of geothermal energy.

Energy from Bio Mass: Photosynthesis, photosynthetic oxygen production, energy plantation, bio gas production from organic wastes by anaerobic fermentation, description of bio-gas plants, transportation of bio-gas, problems involved with bio-gas production, application of bio-gas, application of bio-gas in engines, advantages.

Hydrogen Energy: Properties of Hydrogen with respected to its utilization as a renewable form of energy, sources of hydrogen, production of hydrogen, electrolysis of water, thermal decomposition of water, thermo chemical production bio-chemical production.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Describe the environmental aspects of non-conventional energy resources. In Comparison with various conventional energy systems, their prospects and limitations.

CO2: Know the need of renewable energy resources, historical and latest developments.

CO3: Describe the use of solar energy and the various components used in the energy production with respect to applications like-heating, cooling, desalination, power generation, drying, cooking etc.

CO4: Appreciate the need of Wind Energy and the various components used in energy generation and know the classifications.

CO5: Understand the concept of Biomass energy resources and their classification, types of biogas Plants-applications

CO6: Compare Solar, Wind and bio energy systems, their prospects, Advantages and limitations.

CO7: Acquire the knowledge of fuel cells, wave power, tidal power and geothermal principles and applications.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Non-Convention Energy Resources	B H Khan	McGraw Hill Education (India) Pvt. Ltd.	3rd Edition
2	Solar energy	Subhas P Sukhatme	Tata McGraw Hill	2nd Edition, 1996.
3	Non-Conventional Energy Sources	G.D Rai	Khanna Publishers	2003
Reference Books				
1	Renewable Energy Sources and Conversion Technology	N.K.Bansal, Manfred Kleeman&MechaelMeliss	Tata McGraw Hill.	2004
2	Renewable Energy Technologies	Ramesh R & Kumar K U	Narosa Publishing House New Delhi	
3	Conventional Energy Systems	K M, Non	Wheeler Publishing Co. Ltd., New Delhi	2003

4	Non-Conventional Energy	Ashok V Desai	Wiley Eastern Ltd, New Delhi	2003

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER –VI
OPEN ELECTIVE A

WORLD CLASS MANUFACTURING

Course Code	**18ME652**	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To understand the concept of world class manufacturing, dynamics of material flow, and Lean manufacturing.
- To familiarize the students with the concepts of Business excellence and competitiveness.
- To apprise the students with the need to meet the current and future business challenges.
- To prepare the students to understand the current global manufacturing scenario.

Module-1

Historical Perspective World class Excellent organizations – Models for manufacturing excellence: Schonberger, Halls, Gunn and Maskell models, Business Excellence.

Module-2

Benchmark, Bottlenecks and Best Practices, Concepts of benchmarking, Bottleneck and best practices, Best performers – Gaining competitive edge through world class manufacturing – Value added manufacturing – Value Stream mapping – Eliminating waste –Toyota Production System –Example.

Module-3

System and Tools for World Class Manufacturing. Improving Product & Process Design – Lean Production – SQC, FMS, Rapid Prototyping, Poka Yoke, 5-S,3 M, JIT, Product Mix , Optimizing , Procurement & stores practices , Total Productive maintenance, Visual Control.

Module-4

Human Resource Management in WCM: Adding value to the organization– Organizational learning – techniques of removing Root cause of problems–People as problem solvers–New organizational structures. Associates–Facilitators– Teamsmanship–Motivation and reward in the age of continuous improvement.

Module-5

Typical Characteristics of WCM Companies Performance indicators like POP, TOPP and AMBITE systems– what is world class Performance –Six Sigma philosophy.
Indian Scenario on world class manufacturing –Task Ahead. Green Manufacturing, Clean manufacturing, Agile manufacturing.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand recent trends in manufacturing.
CO2: Demonstrate the relevance and basics of World Class Manufacturing.
CO3: Understand customization of product for manufacturing.
CO4: Understand the implementation of new technologies.
CO5: Compare the existing industries with WCM industries.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Updated on 16.04.2020/28092020

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	World Class Manufacturing- Strategic Perspective	Sahay B.S., Saxena KBC. and Ashish Kumar	Mac Milan Publications	New Delhi
2	Just In Time Manufacturing	Korgaonkar M.G	MacMilan Publications	
Reference Books				
1	Production and Operational Management	Adam and Ebert	Prentice Hall learning Pvt. Ltd.	5th Edition
2	The Toyota Way – 14 Management Principles	Jeffrey K.Liker	Mc-Graw Hill	2003
3	Operations Management for Competitive Advantage	Chase Richard B., Jacob Robert	McGraw Hill Publications	11th Edition 2005
4	Making Common Sense Common Practice	Moore Ron	Butterworth-Heinemann	2002
5	World Class Manufacturing- The Lesson of Simplicity	Schonberger R. J	Free Press	1986

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER –VI
OPEN ELECTIVE A

SUPPLY CHAIN MANAGEMENT

Course Code	**18ME653**	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To acquaint with key drivers of supply chain performance and their inter-relationships with strategy.
- To impart analytical and problem-solving skills necessary to develop solutions for a variety of supply chain management & design problems.
- To study the complexity of inter-firm and intra-firm coordination in implementing programs such as e-collaboration, quick response, jointly managed inventories and strategic alliances.

Module-1

Introduction: Supply Chain – Fundamentals –Evolution- Role in Economy - Importance - Decision Phases – Supplier Manufacturer-Customer chain. - Enablers/ Drivers of Supply Chain Performance. Supply chain strategy - Supply Chain Performance Measures.

Module-2

Strategic Sourcing Outsourcing – Make Vs buy - Identifying core processes - Market Vs Hierarchy - Make Vs buy continuum -Sourcing strategy - Supplier Selection and Contract Negotiation. Creating a world class supply base- Supplier Development - World Wide Sourcing.

Module-3

Warehouse Management Stores management-stores systems and procedures-incoming materials control-stores accounting and stock verification Obsolete, surplus and scrap-value analysis-material handling-transportation and traffic management -operational efficiency-productivity-cost effectiveness-performance measurement.

Supply Chain Network Distribution Network Design – Role - Factors Influencing Options, Value Addition – Distribution Strategies - Models for Facility Location and Capacity allocation. Distribution Center Location Models.

Module-4

Supply Chain Network optimization models. Impact of uncertainty on Network Design - Network Design decisions using Decision trees. Planning Demand, -multiple item -multiple location inventory management. Pricing and Revenue Management.

Module-5

Current Trends: Supply Chain Integration - Building partnership and trust in Supply chain Value of Information: Bullwhip Effect - Effective forecasting - Coordinating the supply chain. Supply Chain restructuring, Supply Chain Mapping - Supply Chain process restructuring, Postpone the point of differentiation – IT in Supply Chain - Agile Supply Chains -Reverse Supply chain. Future of IT in supply chain- E-Business in supply chain.

Course Outcomes: At the end of the course the student will be able to:

CO1: Understand the framework and scope of supply chain management.

CO2: Build and manage a competitive supply chain using strategies, models, techniques and information technology.

CO3: Plan the demand, inventory and supply and optimize supply chain network.

CO4: Understand the emerging trends and impact of IT on Supply chain.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.

- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Supply Chain Management– Text and Cases	Janat Shah	Pearson Education	2009
2	Supply Chain Management- Strategy Planning and Operation	Sunil Chopra and Peter Meindl	PHI Learning / Pearson Education	2007
Reference Books				
1	Business Logistics and Supply Chain Management	Ballou Ronald H	Pearson Education	5th Edition, 2007
2	Designing and Managing the Supply Chain: Concepts, Strategies, and Cases	David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi	Tata McGraw-Hill	2005
3	Supply Chain Management- Concept and Cases	Altekar Rahul V	PHI	2005
4	Modeling the Supply Chain	Shapiro Jeremy F	Thomson Learning	Second Reprint , 2002
5	Principles of Supply Chain Management- A Balanced Approach	Joel D. Wisner, G. Keong Leong, Keah-Choon Tan	South-Western, Cengage Learning	2008

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER –VI
OPEN ELECTIVE A

ADVANCED MATERIALS TECHNOLOGY

Course Code	**18ME654**	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To impart knowledge on material selection methods and basics of advanced engineering materials.
- To introduce the basics of smart materials, composite materials, ceramics and glasses and modern metallic materials and their applications in engineering.

Module-1

Classification and Selection of Materials: Classification of materials, properties required in Engineering materials, Selection of Materials; Motivation for selection, cost basis and service requirements - Selection for mechanical properties, strength, toughness, fatigue and creep - Selection for surface durability corrosion and wear resistance – Relationship between materials selection and processing - Case studies in materials selection with relevance to aero, auto, marine, machinery and nuclear applications.

Module-2

Composite Materials: Fiber reinforced, laminated and dispersed materials with metallic matrix of aluminium, copper and Titanium alloys and with non-metallic matrix of unsaturated polyesters and epoxy resins. Development, Important properties and applications of these materials.

Module-3

Ceramics and Glasses - Bio-ceramics: Nearly inert ceramics, bio-reactive glasses and glass ceramics, porous ceramics; Calcium phosphate ceramics: grafts, coatings Physico-chemical surface modification of materials used in medicine.

Low & High Temperature Materials: Properties required for low temperature applications, Materials available for low temperature applications, Requirements of materials for high temperature applications, Materials available for high temperature applications, Applications of low and high temperature materials.

Module-4

Modern Metallic Materials: Dual Steels, Micro alloyed, High Strength Low alloy (HSLA) Steel, Transformation induced plasticity (TRIP) Steel, Maraging Steel, Inter metallics, Ni and Ti Aluminides.

Non-metallic Materials: Polymeric materials and their molecular structures, Production Techniques for Fibers, Foams, Adhesives and Coatings, structure, Properties and Applications of Engineering Polymers.

Module-5

Smart Materials: Shape Memory Alloys, Varistors and Intelligent materials for bio-medical applications.

Nanomaterials: Definition, Types of nanomaterials including carbon nanotubes and nanocomposites, Physical and mechanical properties, Applications of nanomaterials.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Explain the concepts and principles of advanced materials and manufacturing processes.

CO2: Understand the applications of all kinds of Industrial materials.

CO3: Apply the material selection concepts to select a material for a given application.

CO4: Define Nanotechnology, Describe nano material characterization.

CO5: Understand the behaviour and applications of smart materials, ceramics, glasses and non-metallic materials.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Reference Books				
1	Engineering Material Technology	James A. Jacobs & Thomas F. Kilduff	Prentice Hall	
2	Materials Science and Engineering	WD. Callister Jr.	Wiley India Pvt. Ltd	2010
3	Engineering Design: A Materials and Processing Approach	G.E. Dieter	McGraw Hill	1991
4	Materials Selection in Mechanical Design	M.F. Ashby	Pergamon Press	1992
5	Introduction to Engineering Materials & Manufacturing Processes	NIIT	Prentice Hall of India	
6	Engineering Materials Properties and Selection	Kenneth G. Budinski	Prentice Hall of India	
7	Selection of Engineering Materials	Gladius Lewis	Prentice-Hall, New Jersey	

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B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

COMPUTER AIDED MODELLING AND ANALYSIS LAB

Course Code	**18MEL66**	CIE Marks	40
Teaching Hours /Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To acquire basic understanding of Modeling and Analysis software
- To understand the concepts of different kinds of loading on bars, trusses and beams, and analyze the results pertaining to various parameters like stresses and deformations.
- To lean to apply the basic principles to carry out dynamic analysis to know the natural frequencies of different kind of beams.

Sl. No.	Experiments
	PART A
1	**Study of a FEA package and modeling and stress analysis of:** a. Bars of constant cross section area, tapered cross section area and stepped bar b. Trusses – (**Minimum 2 exercises of different types)** c. Beams – Simply supported, cantilever, beams with point load , UDL, beams with varying load etc. **(Minimum 6 exercises)** d. Stress analysis of a rectangular plate with a circular hole.
	PART B
2	Thermal Analysis – 1D & 2D problem with conduction and convection boundary conditions **(Minimum 4 exercises of different types)**
3	Dynamic Analysis to find: a) Natural frequency of beam with fixed – fixed end condition b) Response of beam with fixed – fixed end conditions subjected to forcing function c) Response of Bar subjected to forcing functions
	PART C(only for demo)
4	a. Demonstrate the use of graphics standards (IGES, STEP etc) to import the model from modeler to solver. b. Demonstrate one example of contact analysis to learn the procedure to carry out contact analysis. c. Demonstrate at least two different types of example to model and analyze bars or plates made from composite material.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Use the modern tools to formulate the problem, create geometry, descritize, apply boundary conditions to
solve problems of bars, truss, beams, and plate to find stresses with different-loading conditions.

CO2: Demonstrate the ability to obtain deflection of beams subjected to point, uniformly distributed and varying loads and use the available results to draw shear force and bending moment diagrams.

CO3: Analyze and solve 1D and 2D heat transfer conduction and convection problems with different boundary conditions.

CO4: Carry out dynamic analysis and finding natural frequencies of beams, plates, and bars for various boundary conditions and also carry out dynamic analysis with forcing functions.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.

Scheme of Examination:

One Question from Part A - 40 Marks
One Question from Part B - 40 Marks
Viva-Voce - 20 Marks

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

HEAT TRANSFER LAB

Course Code	**18MEL67**	CIE Marks	40
Teaching Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- The primary objective of this course is to provide the fundamental knowledge necessary to understand the behavior of thermal systems.
- This course provides a detailed experimental analysis, including the application and heat transfer through solids, fluids, and vacuum.
- Convection, conduction, and radiation heat transfer in one and two dimensional steady and unsteady systems are examined.

Sl. No.	**Experiments**
	PART A
1	Determination of Thermal Conductivity of a Metal Rod.
2	Determination of Overall Heat Transfer Coefficient of a Composite wall.
3	Determination of Effectiveness on a Metallic fin.
4	Determination of Heat Transfer Coefficient in free Convection
5	Determination of Heat Transfer Coefficient in a Forced Convention
6	Determination of Emissivity of a Surface.
	PART B
7	Determination of Stefan Boltzmann Constant.
8	Determination of LMDT and Effectiveness in a Parallel Flow and Counter Flow Heat Exchangers.
9	Experiments on Boiling of Liquid and Condensation of Vapour.
10	Performance Test on a Vapour Compression Refrigeration.
11	Performance Test on a Vapour Compression Air – Conditioner.
12	Experiment on Transient Conduction Heat Transfer.
	PART C (OPTIONAL)
13	Analysis of steady and transient heat conduction, temperature distribution of plane wall and cylinder using Numerical approach (ANSYS/CFD package).
14	Determination of temperature distribution along a rectangular and circular fin subjected to heat loss through convection using Numerical approach (ANSYS/CFD package).

Course Outcomes: At the end of the course, the student will be able to:

CO1: Determine the thermal conductivity of a metal rod and overall heat transfer coefficient of composite slabs.

CO2: Determine convective heat transfer coefficient for free and forced convection and correlate with theoretical values.

CO3: Evaluate temperature distribution characteristics of steady and transient heat conduction through solid cylinder experimentally.

CO4: Determine surface emissivity of a test plate and Stefan Boltzmann constant

CO5: Estimate performance of a refrigerator and effectiveness of a fin and Double pipe heat exchanger

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made

Scheme of Examination:

One Question from Part A - 40 Marks

One Question from Part B - 40 Marks

Viva-Voce - 20 Marks

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B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII

CONTROL ENGINEERING

Course Code	**18ME71**	CIE Marks	40
Teaching Hours / Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To develop comprehensive knowledge and understanding of modern control theory, industrial automation, and systems analysis.
- To model mechanical, hydraulic, pneumatic and electrical systems.
- To represent system elements by blocks and its reduction techniques.
- To understand transient and steady state response analysis of a system.
- To carry out frequency response analysis using polar plot, Bode plot.
- To analyse a system using root locus plots.
- To study different system compensators and characteristics of linear systems.

Module-1

Introduction: Components of a control system, Open loop and closed loop systems.
Types of controllers: Proportional, Integral, Differential, Proportional-Integral, and Proportional- Integral-Differential controllers.
Modelling of Physical Systems: Mathematical Models of Mechanical, Electrical, Thermal, Hydraulic Systems.

Module-2

Time domain performance of control systems: Typical test signal, Unit step response and time domain specifications of first order, second order system. Steady state error, error constants.

Module-3

Block diagram algebra, Reduction of block diagram, Signal flow graphs, Gain formula for signal flow graphs, State diagram from differential equations.

Module-4

Stability of linear control systems: Routh's criterion, Root locus, Determination of phase margin and gain margin using root locus.

Module-5

Stability analysis using Polar plot, Nyquist plot, Bode plot, Determination of phase margin and gain margin using Bode plot.

Assignment:
1.Study of On-Off Controller for Flow/ Temperature.
2. Study of Control Modes like P, PD, PI, PID for Pressure / Temperature / Flow.
3. Assignment on Root Locus, Bode Plots and Polar Plots.
4. Use of Software 'MATLAB' on the above topics.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Identify the type of control and control actions.
CO2: Develop the mathematical model of the physical systems.
CO3: Estimate the response and error in response of first and second order systems subjected standard input signals.
CO4: Represent the complex physical system using block diagram and signal flow graph and obtain transfer function.
CO5: Analyse a linear feedback control system for stability using Hurwitz criterion, Routh's criterion and root Locus technique in complex domain.

CO6: Analyse the stability of linear feedback control systems in frequency domain using polar plots, Nyquist and Bode plots.				

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Automatic Control Systems	Farid G., Kuo B. C	McGraw Hill Education	10th Edition,2018
2	Control systems	Manik D. N	Cengage	2017
Reference Books				
1	Modern control Engineering	K. Ogeta	Pearson	5th Edition, 2010
2	Control Systems Engineering	Norman S Nice		Fourth Edition, 2007
3	Modern control Systems	Richard C Dorf	Pearson	2017
4	Control Systems Engineering	IjNagrath, M Gopal	New Age International (P) Ltd	2018
5	Control Systems Engineering	S Palani	Tata McGraw Hill Publishing Co Ltd	ISBN-13 978007067193

B. E. MECHANICAL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VII			
COMPUTER AIDED DESIGN AND MANUFACTURING			
Course Code	**18ME72**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To impart knowledge of CIM and Automation and different concepts of automation by developing mathematical models.
- To make students to understand the Computer Applications in Design and Manufacturing [CAD / CAM) leading to Computer integrated systems. Enable them to perform various transformations of entities on display devices.
- To expose students to automated flow lines, assembly lines, Line Balancing Techniques, and Flexible Manufacturing Systems.
- To expose students to computer aided process planning, material requirement planning, capacity planning etc.
- To expose the students to CNC Machine Tools, CNC part programming, and industrial robots.
- To introduce the students to concepts of Additive Manufacturing, Internet of Things, and Industry 4.0 leading to Smart Factory.

Module-1

Introduction to CIM and Automation: Automation in Production Systems, automated manufacturing systems- types of automation, reasons for automating, Computer Integrated Manufacturing, computerized elements of a CIM system, CAD/CAM and CIM. Mathematical models and matrices: production rate, production capacity, utilization and availability, manufacturing lead time, work-in- process, numerical problems.

Automated Production Lines and Assembly Systems: Fundamentals, system configurations, applications, automated flow lines, buffer storage, control of production line, analysis of transfer lines, analysis of flow lines without storage, partial automation, analysis of automated flow lines with storage buffer, fundamentals of automated assembly systems, numericals.

Module-2

CAD and Computer Graphics Software: The design process, applications of computers in design**,** software configuration, functions of graphics package, constructing the geometry.

Transformations: 2D transformations, translation, rotation and scaling, homogeneous transformation matrix, concatenation, numerical problems on transformations.

Computerized Manufacture Planning and Control System: Computer Aided Process Planning, Retrieval and Generative Systems, benefits of CAPP, Production Planning and Control Systems, typical activities of PPC System, computer integrated production management system, Material Requirement Planning, inputs to MRP system, working of MRP, outputs and benefits, Capacity Planning, Computer Aided Quality Control, Shop floor control

Module-3

Flexible Manufacturing Systems: Fundamentals of Group Technology and Flexible Manufacturing Systems, types of FMS, FMS components, Material handling and storage system, applications, benefits, computer control systems, FMS planning and design issues, Automated Storage and Retrieval Systems, AS/RS and Automatic parts identification systems and data capture.

Line Balancing: Line balancing algorithms, methods of line balancing, numerical problems on largest candidate rule, Kilbridge and Wester method, and Ranked Positional Weights method, Mixed Model line balancing, computerized line balancing methods.

Module-4

Computer Numerical Control: Introduction, components of CNC, CNC programming, manual part programming, G Codes, M Codes, programming of simple components in turning, drilling and milling systems, programming with canned cycles. Cutter radius compensations.

Robot Technology: Robot anatomy, joints and links, common robot configurations, robot control systems, accuracy and repeatability, end effectors, sensors in robotics. Robot programming methods: on-line and off-line methods. Robot industrial applications: material handling, processing and assembly and inspection.

Module-5

Additive Manufacturing Systems: Basic principles of additive manufacturing, slicing CAD models for AM, advantages and limitations of AM technologies, Additive manufacturing processes: Photo polymerization, material jetting, binder jetting, material extrusion, Powder bed sintering techniques, sheet lamination, direct energy deposition techniques, applications of AM.

Future of Automated Factory: Industry 4.0, functions, applications and benefits. Components of Industry 4.0, Internet of Things (IOT), IOT applications in manufacturing, Big-Data and Cloud Computing for IOT, IOT for smart manufacturing, influence of IOT on predictive maintenance, industrial automation, supply chain optimization, supply-chain & logistics, cyber-physical manufacturing systems.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Define Automation, CIM, CAD, CAM and explain the differences between these concepts. Solve simple problems of transformations of entities on computer screen

CO2: Explain the basics of automated manufacturing industries through mathematical models and analyze different types of automated flow lines.

CO3: Analyse the automated flow linestoreduce time and enhance productivity.

CO4: Explain the use of different computer applications in manufacturing, and able to prepare part programs forsimple jobs on CNC machine tools and robot programming.

CO5: Visualize and appreciate the modern trends in Manufacturing like additive manufacturing, Industry 4.0 and applications of Internet of Things leading to Smart Manufacturing.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Automation, Production Systems and Computer-Integrated Manufacturing	Mikell P Groover	Pearson Learning.	4th Edition,2015
2	CAD / CAM Principles and Applications	P N Rao	Tata McGraw-Hill	3rd Edition, 2015
3	CAD/CAM/CIM	Dr. P. Radhakrishnan	New Age International Publishers, New Delhi.	3rd edition
Reference Books				
1	“CAD/CAM”	Ibrahim Zeid	Tata McGraw Hill.	
2	Principles of Computer Integrated Manufacturing	S.Kant Vajpayee	, Prentice Hall of India, New Delhi.	1999

3	Work Systems And The Methods, Measurement And Management of Work	Groover M. P.,Pearson	Prentice Hall	Upper Saddle River, NJ, 2007.
4	Computer Automation in Manufacturing	Boucher, T. O., Chapman & Hall	London, UK,	1996.
5	Introduction to Robotics: Mechanics And Control	Craig, J. J.	Addison-Wesley Publishing Company	2nd Ed 1989.
6	Internet of Things (IoT): Digitize or Die: Transform your organization. Embrace the digital evolution. Rise above the competition	Nicolas Windpassinger	Amazon.	
7	Internet of Things: A Hands-on Approach"	ArshdeepBahga and Vijay Madisetti	Universities Press	
8	Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing,	Ian Gibson, David W. Rosen, Brent Stucker		2nd Ed. (2015)
9	Understanding Additive Manufacturing	Andreas Gebhardt, Hanser Publishers		2011
10	Understanding Additive Manufacturing”,	Andreas Gebhardt,	Hanser Publishers,	2011

B. E. MECHANICAL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER – VII Professional Elective 2			
DESIGN FOR MANUFACTURE			
Course Code	**18ME731**	CIE Marks	40
Teaching Hours / Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To educate students on factors to be considered in designing parts and components with focus on manufacturability.
- To expose the students to dimensional tolerances, geometric tolerances and true position tolerance techniques in manufacture.
- To impart the knowledge on design considerations for designing components produced using various machining operations like turning, drilling, milling, grinding etc.
- To educate the students on design rules and recommendations for processes like casting, welding, forgings powder metallurgy and injection moulding.

Module-1

Introduction: Definition, need for DFM, DFM approach for cost reduction, general design guide lines of DFM, advantages and disadvantages, application of DFM in industries, Design for Quality Manufacturability, DFQM approach, designing for economical production. Design for Excellence (DFX).

Engineering Tolerancing: Basics of dimensional tolerancing, Redundancy, tolerance allocation, Review of relationship between attainable tolerance grades and different machining processes. Geometrical tolerances. Process capability, mean, variance, skewness, kurtosis, process capability indices- C_p, and C_{pk}. Cumulative effect of tolerance- Sure fit law and truncated normal law, problems.

Module-2

True positional theory: Comparison between coordinate and true position method of feature location. True position tolerance- virtual size concept, concepts of datum and changing datum, floating and fixed fasteners, projected tolerance zone and functional gages. Concept of Zero true position tolerance. Simple problems on true position tolerancing.

Selective Assembly: Interchangeable part manufacture and selective assembly. Deciding the number of groups -model-1: group tolerance of mating parts equal, model- 2: total and group tolerances of shaft equal. Control of axial play- introducing secondary machining operations, and laminated shims; examples.

Module-3

Datum Features: Functional datum, datum for manufacturing, changing the datum; examples.

Component Design: Design features to facilitate machining: drills, milling cutters, keyways, Doweling procedures, counter sunk screws, Reduction of machined area, simplification by separation, simplification by amalgamation, Design for machinability, Design for economy, Design for clampability, Design for accessibility.
Designing for heat treatment, roller burnishing, and economical de-burring.

Module-4

Design of components with casting considerations: Pattern, mould, and parting line. Cored holes and machined holes. Identifying the possible and probable parting lines. Castings requiring special sand cores. Designing to obviate sand cores.

Welding considerations: Advantages of weldments over other design concepts, design requirements and rules, redesign of components for welding; case studies.

Module-5
Forging considerations -requirements and rules-redesign of components for forging and case studies. **Design of components for powder metallurgy**- requirements and rules-case studies. **Design of components for injection moulding**- requirements and rules-case studies.
Course Outcomes: At the end of the course, the student will be able to: CO1: Select proper materials and manufacturing processes for designing products/components by applying the relevant principles for ease and economic production. CO2: Identify faulty design factors leading to increased costs in producing mechanical components. CO3: Apply appropriate design tolerances – dimensional, geometric and true position tolerances for the production processes of mechanical components. CO4: Apply the concepts related to reducing machined areas, simplification by amalgamation and separation, clampability, accessibility etc., in the design of mechanical components. CO5: Analyse the design of castings, weldments, forgings, powder metallurgy components and suggest design modifications to reduce the cost.
Question paper pattern: • The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks. • There will be two full questions (with a maximum of four sub- questions) from each module. • Each full question will have sub- question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Designing for Manufacture	Peck H	Pitman Publications	1983
2	Engineering Design: A Materials and processing Approach	Dieter, G.E.	McGraw Hill Co.Ltd	2000
3	Handbook of Products Design for Manufacturing: A Practical Guide to Low-cost Production	Bralla, James G.	McGraw Hill, New York	1986
Reference Books				
1	Engineering Design	Eggert, R.J	Pearson Education, Inc., New Jersey	2005
2	Engineering Design	Matousek , R	Blackie and Son Limited, Glasgow	1967
3	Engineering Design for Manufacture	Kalandar Saheb, S.D and Prabhakar, O.	ISPE	1999
4	Design for Economical Production	Trucks, H.E.	Mich., Dearborn, SME	2nd ed.,1987
5	Processes and Materials of Manufacture	Linberg, Roy A.	Allyn and Bacon, Boston, U.S.A.	4th ed., 1990

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII
Professional Elective 2

AUTOMATION & ROBOTICS

Course Code	**18ME732**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:2:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To identify potential areas for automation and justify need for automation.
- To select suitable major control components required to automate a process or an activity
- To study the various parts of robots and fields of robotics.
- To study the various kinematics and inverse kinematics of robots.
- To study the control of robots for some specific applications.

Module-1:

Introduction to automation:
Basic elements of an automated system, advanced automation functions, levels of automation, process industries versus discrete manufacturing industries, continuous versus discrete control, computer process control. Hardware components for automation and process control, sensors, actuators, analog to digital converters, digital to analog converters, input/output devices for discrete data

Module-2:

Automated production lines:
Fundamentals of automated production lines, application of automated production lines, analysis of transfer lines, automated assembly systems, fundamentals of automated assembly systems, quantitative analysis of assembly systems, automatic identification methods, barcode technology, radio frequency identification, other AIDC technologies

Module-3: Industrial Robotics

Robotic configuration, robot anatomy and related attributes, robot control systems, end effectors, sensors in robotics, industrial robot applications, robot accuracy and repeatability, different types of robots, various generations of robots, degrees of freedom – Asimov's laws of robotics, dynamic stabilization of robots.

Module-4: Spatial descriptions and transformations

Robot actuators and Feedback components: Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison. Position sensors –potentiometers, resolvers, encoders –Velocity sensors, Tactile sensors, Proximity sensors. Manipulator Kinematics: Homogeneous transformations as applicable to rotation and translation -D-H notation, Forward and inverse kinematics.

Module-5: Robot programming

Introduction, levels of robot programming, requirements of robot programming language, problems pertaining to robot programming languages, offline programming systems, central issues in OLP systems, automating subtasks in OLP systems, simple programs on robot applications.

Course Outcomes: At the end of the course, the student will be able to:
CO1: Translate and simulate a real time activity using modern tools and discuss the Benefits of automation.
CO2: Identify suitable automation hardware for the given application.
CO3: Recommend appropriate modelling and simulation tool for the given manufacturing Application.
CO4: Explain the basic principles of Robotic technology, configurations, control and Programming of Robots.
CO5: Explain the basic principles of programming and apply it for typical Pick & place, Loading & unloading and palletizing applications

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.

- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Computer Integrated Manufacturing	Mikell P. Groover	Pearson	3rd edition, 2009
2	Introduction to robotics mechanics and control	John J. Craig	Pearson	3rd edition, 2009
Reference Books				
1	Robotics for Engineers	Yoram Koren	McGraw Hill International	1st edition, 1985.
2	Industrial Robotics	Weiss, Nagel	McGraw Hill International	2nd edition, 2012
3	Robotic Engineering - An Integrated approach	Klafter, Chmielewski and Negin	PHI	1st edition, 2009
4	Computer Based Industrial Control	Krishna Kant	EEE-PHI	2nd edition,2010
5	An Introduction to Automated Process Planning System	Tiess Chiu Chang & Richard A. Wysk.		

B. E. MECHANICAL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER – VII Professional Elective 2			
COMPUTATIONAL FLUID DYNAMICS			
Course Code	**18ME733**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- Study the governing equations of fluid dynamics
- Learn how to formulate and solve Euler's equation of motion.
- Become skilled at Representation of Functions on Computer
- Solve computational problems related to fluid flows

Module-1

Introduction to CFD and Governing Equations

Need of CFD as tool, role in R&D, continuum, material or substantial derivative or total derivative, gradient, divergence and curl operators, Linearity, Principle of Superposition. Derivation of Navier-Stokes equations in control volume (integral form) and partial differential form, Euler equations (governing inviscid equations). Mathematical classification of PDE (Hyperbolic, Parabolic, Elliptic). Method of characteristics, Introduction to Riemann Problem and Solution Techniques.

Module-2

One-dimensional Euler's equation

Conservative, Non-conservative form and primitive variable forms of Governing equations. Flux Jacobian Is there a systematic way to diagona lize '**A**'. Eigen values and Eigenvectors of Flux Jacobian. Decoupling of Governing equations, introduction of characteristic variables. Relation between the two non-conservative forms. Conditions for genuinely nonlinear characteristics of the flux Jacobian.

Introduction to Turbulence Modelling: Derivation of RANS equations and k-epsilon model.

Module-3

Representation of Functions on Computer

Need for representation of functions, Box Function, Hat Function, and Representation of sinx using hat functions: Aliasing, high frequency, low frequency. Representation error as a global error. Derivatives of hat functions, Haar functions, Machine Epsilon. Using Taylor series for representation of Derivatives.

Module-4

Finite difference method – Applied to Linear Convection equation, Laplace Equations, Convection Diffusion equations, Burgers equations, modified equations. Explicit methods and Implicit methods – as applied to applied to linear convection equation, Laplace equations, convection-diffusion equation◦ FTCS,FTFS,FTBS,CTCS ◦ Jacobi Method, Gauss-Siedel, Successive Over Relaxation Method, TDMA• Von Naumann stability (linear stability) analysis. Upwind Method in Finite Difference method.

Module-5

Finite volume method Finite volume method. Finding the flux at interface.

Central schemes - Lax-Friedrichs Method, Lax-Wendroff Method, Two-Step Lax-Wendroff Method and Mac Cormack Method

Upwind Method in Finite Volume methods - Flux Splitting Method Steger and Warming, vanLeer, Roe's Method and finding Roe's Averages.

Course Outcomes:

At the end of the course the student will be able to:

CO1: Understand mathematical characteristics of partial differential

equations.
CO2: Explain how to classify and computationally solve Euler and Navier-Stokes equations.
CO3: Make use of the concepts like accuracy, stability, consistency of numerical methods for the governing equations.
CO4: Identify and implement numerical techniques for space and time integration of partial differential equations.
CO5: Conduct numerical experiments and carry out data analysis.
CO6: Acquire basic skills on programming of numerical methods used to solve the Governing equations.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Computational Fluid Dynamics	T.j.chung	Cambridge University Press	
2	Computational fluid dynamics and heat transfer	Ghoshdastidar	Cengage learning	2017
3	Numerical Computation of Internal and External Flows: The Fundamentals of Computational Fluid Dynamics – Vol 1 & Vol 2	Charles Hirsch	Butterworth- Heinemann	2007
4	Numerical Heat Transfer and Fluid Flow	SuhasPatankar	Taylor and Francis Publisher	
5	Introduction Computational Fluid Dynamics -Development, Application and Analysis	Atul Sharma	Wiely Publisher	
Reference Books				
1	Computational fluid mechanics and heat transfer	Pletcher, r. H., Tannehill, j. C., Anderson, d.	Crc press, ISBN 9781591690375	3rd ed, 2011
2	Fundamentals of engineering numerical analysis	Moin, p	Cambridge university press, , ISBN 9780521805261	2nd ed, 2010
3	Numerical methods for engineering application	Ferziger, j. H	Wiley	2nd ed, 1998
4	Computational methods for fluid dynamics	Ferziger, j. H., Peric, m	Springer	3rd ed
5	Numerical methods for conservation laws	eth Zurich, birkhauser		pp-199
6	Practical Introduction	Eleuterio F Toro	Springer	

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B. E. MECHANICAL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER – VII Professional Elective 2			
TOTAL QUALITY MANAGEMENT			
Course Code	**18ME734**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- Understand various approaches to TQM
- Understand the characteristics of quality leader and his role.
- Develop feedback and suggestion systems for quality management.
- Enhance the knowledge in Tools and Techniques of quality management.

Module-1

Principles and Practice: Definition, basic approach, gurus of TQM, TQM Framework, awareness, defining quality, historical review, obstacles, benefits of TQM. Quality Management Systems: Introduction, benefits of ISO registration, ISO 9000 series of standards, ISO 9001 requirements.

Module-2

Leadership: Definition, characteristics of quality leaders, leadership concept, characteristics of effective people, ethics, the Deming philosophy, role of TQM leaders, implementation, core values, concepts and framework, strategic planning communication, decision making,

Module-3

Customer Satisfaction and Customer Involvement: Customer Satisfaction: customer and customer perception of quality, feedback, using customer complaints, service quality, translating needs into requirements, customer retention, case studies. Employee Involvement – Motivation, employee surveys, empowerment, teams, suggestion system, recognition and reward, gain sharing, performance appraisal, unions and employee involvement, case studies.

Module-4

Continuous Process Improvement: process, the Juran trilogy, improvement strategies, types of problems, the PDSA Cycle, problem-solving methods, Kaizen, reengineering, six sigma, case studies. Statistical Process Control: Pareto diagram, process flow diagram, cause and effect diagram, check sheets, histograms, statistical fundamentals, Control charts, state of control, out of control process, control charts for variables, control charts for attributes, scatter diagrams, case studies.

Module-5

Total Productive Maintenance (TPM): Definition, Types of Maintenance, Steps in introduction of TPM in an organization, Pillars of TPM – 5S, Jishu Hozen, Quality Maintenance, Planned Maintenance.
Quality by Design (QbD): Definition, Key components of QbD, Role of QbD in Pharmaceutical Industry, Benefits and Challenges of QbD.
Environmental Management Systems (EMS): Definition, Basic EMS, EMS under ISO 14001, Costs and Benefits of EMS.

Course Outcomes: At the end of the course, the student will be able to:
CO1: Explain the various approaches of TQM
CO2: Infer the customer perception of quality
CO3: Analyse customer needs and perceptions to design feedback systems.
CO4: Apply statistical tools for continuous improvement of systems
CO5: Apply the tools and technique for effective implementation of TQM.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Total Quality Management	Dale H. Besterfield	Pearson Education India,	Edition 03. ISBN: 8129702606,
2	Total Quality Management for Engineers	M. Zairi	Wood head Publishing	ISBN:1855730243
Reference Books				
1	Managing for Quality and Performance Excellence	James R. Evans and William M Lindsay	Cengage Learning.	9th edition
2	Four revolutions in management	Shoji Shiba, Alan Graham, David Walden	Oregon	1990
3	Organizational Excellence through TQM	H. Lal	New age Publications	2008
4	Engineering Optimization Methods and Applications	A Ravindran, K, M. Ragsdell	Willey India Private Limited	2nd Edition,2006
5	Introduction to Operations Research- Concepts and Cases	F.S. Hillier. G.J. Lieberman	Tata McGraw Hill	9th Edition, 2010

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII
Professional Elective 2

OPERATIONS RESEARCH

Course Code	**18ME735**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To enable the students to understand the scientific methods of providing various departments of an organization with a quantitative basis of decision making.
- To enable the students to understand the importance of various tools and techniques in finding optimal solutions to problems involving limited resources in the form of Men, Materials and machinery.

Module-1

Introduction: Evolution of OR, Definitions of OR, Scope of OR, Applications of OR, Phases in OR study. Characteristics and limitations of OR, models used in OR, Linear Programming Problem (LPP), Generalized LPP- Formulation of problems as L.P.P. Solutions to LPP by graphical method (Two Variables).

Module-2

LPP: Simplex method, Canonical and Standard form of LP problem, slack, surplus and artificial variables, Solutions to LPP by Simplex method, Big-M Method and two-phase Simplex Method, Degeneracy in LPP. Concept of Duality, writing Dual of given LPP. Solutions to L.P.P by Dual Simplex Method.

Module-3

Transportation Problem: Formulation of transportation problem, types, initial basic feasible solution using North-West Corner rule, Vogel's Approximation method. Optimality in Transportation problem by Modified Distribution (MODI) method. Unbalanced T.P. Maximization T.P. Degeneracy in transportation problems, application of transportation problem. Assignment Problem-Formulation, Solutions to assignment problems by Hungarian method, Special cases in assignment problems, unbalanced, Maximization assignment problems. Travelling Salesman Problem (TSP). Difference between assignment and T.S.P, Finding best route by Little's method. Numerical Problems.

Module-4

Network analysis: Introduction, Construction of networks, Fulkerson's rule for numbering the nodes, AON and AOA diagrams; Critical path method to find the expected completion time of a project, determination of floats in networks, PERT networks, determining the probability of completing a project, predicting the completion time of project; Cost analysis in networks. Crashing of networks- Problems. Queuing Theory: Queuing systems and their characteristics, Pure-birth and Pure-death models (only equations), Kendall & Lee's notation of Queuing, empirical queuing models – Numerical on M/M/1 and M/M/C Queuing models.

Module-5

Game Theory: Definition, Pure Strategy problems, Saddle point, Max-Min and Min-Max criteria, Principle of Dominance, Solution of games with Saddle point. Mixed Strategy problems. Solution of 2X2 games by Arithmetic method, Solution of 2Xn m and mX2 games by graphical method. Formulation of games. Sequencing: Basic assumptions, Johnson's algorithm, sequencing 'n' jobs on single machine using priority rules, sequencing using Johnson's rule-'n' jobs on 2 machines, 'n' jobs on 3 machines, 'n' jobs on 'm' machines. Sequencing of2 jobs on 'm' machines using graphical method.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand the meaning, definitions, scope, need, phases and techniques of operations research.

CO2: Formulate as L.P.P and derive optimal solutions to linear programming problems by graphical method, Simplex method, Big-M method and Dual Simplex method.

CO3: Formulate as Transportation and Assignment problems and derive optimum solutions for transportation,

Assignment and travelling salesman problems.
CO4: Solve problems on game theory for pure and mixed strategy under competitive environment.
CO5: Solve waiting line problems for M/M/1 and M/M/K queuing models.
CO6: Construct network diagrams and determine critical path, floats for deterministic and PERT networks including crashing of Networks
CO7: Determine minimum processing times for sequencing of n jobs-2 machines, n jobs-3 machines, n jobs-m machines and 2 jobs-n machines using Johnson's algorithm.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Operations Research	P K Gupta and D S Hira	S. Chand and Company LTD. Publications, New Delhi	2007
2	Operations Research, An Introduction	Hamdy A. Taha	PHI Private Limited	Seventh Edition, 2006
Reference Books				
1	Operations Research, Theory and Applications	J K Sharma	Trinity Press, Laxmi Publications Pvt.Ltd.	Sixth Edition, 2016
2	Operations Research	Paneerselvan	PHI	
3	Operations Research	A M Natarajan, P Balasubramani	Pearson Education,	2005
4	Introduction to Operations Research	Hillier and Lieberman	McGraw Hill	8thEd

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII
Professional Elective 3

ADDITIVE MANUFACTURING

Course Code	**18ME741**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To know the principle methods, areas of usage, possibilities and limitations of the Additive Manufacturing technologies.
- To be familiar with the characteristics of the different materials those are used in Additive Manufacturing.
- To know the principles of polymerization and powder metallurgy process, extrusion-based system printing processes, sheet lamination processes, beam deposition processes, direct write technologies and Direct Digital Manufacturing.
- To get exposed to process selection, software issues and post processing.

Module-1

Introduction and basic principles: Need for Additive Manufacturing, Generic AM process, stereoli tho graphy or 3dprinting, rapid proto typing ,the benefits of AM, distinction between AM and CNC machining, other related technologies- reverse engineering technology.
Development of Additive Manufacturing Technology: Introduction, computers, computer-aidedde sign technology ,other associated technologies, the use of layers, classification of AM processes, metals ystems, hybrid systems, milestones in AM development.
Additive Manufacturing Process chain: Introduction, the eight steps in additive manufacture, variations from one AM machine to another ,metal systems, maintenance of equipment, materials handling issues, design for AM, and application areas.

Module-2

Photo polymerization processes: Stereolitho graphy (SL), Materials, SL resin curing process, Micro-stereoli thography, Process Benefits and Drawbacks, Applications of Photo polymerization Processes.
Powder bedfusion processes: Introduction, Selective laser Sintering (SLS), Materials, Powder fusion mechanism, SLS Metal and ceramic part creation, Electron Beam melting (EBM), Process Benefits and Drawbacks, Applications of Powder Bed Fusion Processes.
Extrusion-based systems: Fused Deposition Modelling (FDM), Principles, Materials, Plotting and path control, Bio-Extrusion, Process Benefits and Drawbacks, Applications of Extrusion-Based Processes.

Module-3

Printing Processes: evolution of printing as an additive manufacturing process, research achievements in printing deposition, technical challenges of printing, printing process modeling, material modification methods, three-dimensional printing, advantages of binder printing
Sheet Lamination Processes: Materials, Laminated Object Manufacturing (LOM), Ultrasonic Consolidation (UC), Gluing, Thermal bonding, LOM and UC applications.
Beam Deposition Processes: introduction, general beam deposition process, description material delivery, BD systems , process parameters, typical materials and microstructure, processing–structure–properties relationships, BD benefits and drawbacks.
Direct Write Technologies: Background ,ink -basedDW,laser transfer, DW thermals pray,DW beam deposition,DW liquid-phase directde position.

Module-4

Guidelines for Process Selection: Introduction, selection methods for apart, challenges of selection, example system for preliminary selection, production planning and control.
Software issues for Additive Manufacturing: Introduction, preparation of cad models – the STL file, problems with STL files, STL file manipulation.
Post- Processing: Support material removal**,** surface texture improvements**,** preparation for use as a pattern, property enhancements using non-thermal techniques and thermal techniques**.**

Module-5

The use of multiple materials in additive manufacturing: Introduction, multiple material approaches, discrete multiple material processes, porous multiple material processes, blended multiple material processes, commercial applications using multiple materials, future directions.
AM Applications: Functional models, Pattern for investment and vacuum casting, Medical models, art models, Engineering analysis models, Rapid tooling, new materials development, Bi-metallic parts, Re-manufacturing. Application: Examples for Aerospace, defense, automobile, Bio-medical and general engineering industries.
Direct digital manufacturing: Align Technology, siemens and phonak, DDM drivers, manufacturing vs. prototyping, life- cycle costing, future of direct digital manufacturing.

Course Outcomes: At the end of the course the student will be able to:

CO1: Demonstrate the knowledge of the broad range of AM processes, devices, capabilities and materials that are available.
CO2: Demonstrate the knowledge of the broad range of AM processes, devices, capabilities and materials that are available.
CO3: Understand the various software tools, processes and techniques that enable advanced/additive manufacturing.
CO4: Apply the concepts of additive manufacturing to design and create components that satisfy product development/prototyping requirements, using advanced/additive manufacturing devices and processes.
CO6: Understand characterization techniques in additive manufacturing.
CO7: Understand the latest trends and business opportunities in additive manufacturing.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Additive Manufacturing Technologies Rapid Prototyping to Direct Digital Manufacturing	I. Gibson l D. W. Rosen l B. Stucker	Springer New York Heidelberg Dordrecht, London	ISBN: 978-1-4419-1119-3 e-ISBN: 978-1-4419-1120-9 DOI 10.1007/978-1-4419-1120-9
Reference Books				
1	"Rapid Prototyping: Principles & Applications	Chua Chee Kai, Leong Kah Fai	World Scientific	2003
2	Rapid Prototyping: Theory & Practice	Ali K. Kamrani,	Springer	2006

		EmandAbouel Nasr,		
3	Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling”	D.T. Pham, S.S. Dimov	Springer	2001
4	Rapid Prototyping: Principles and Applications in Manufacturing	RafiqNooran	John Wiley & Sons	2006
5	Additive Manufacturing Technology	Hari Prasad, A.V.Suresh	Cengage	2019
6	Understanding additive manufacturing: rapid prototyping, rapid tooling, rapid manufacturing	Andreas Gebhardt	Hanser Publishers	2011

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII
Professional Elective 3

EMERGING SUSTAINABLE BUILDING COOLING TECHNOLOGIES

Course Code	**18ME742**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To provide an overview of emerging delivery systems for high performance green buildings and the basis on which their sustainability can be evaluated
- To know the concepts of calculations of heating and cooling loads and the related economics.
- To learn the importance of green fuels and its impact on environment.
- To expose the students to sustainable cooling technologies.

Module-1

Social and Environmental Issues related to conventional Refrigeration and Air conditioning: Climate Change and energy poverty implications of energy consumption and refrigerants use by conventional Vapor-Compression based RAC technologies, Global and Indian environmental, energy efficiency and green building policies, laws and rules warranting a trajectory shift in the RAC economy, Introduction to Thermal comfort as an 'ends' and cooling systems as a 'means', Socio-economic and environmental benefits of a Negawatt approach to energy conservation vs. a Megawatt approach towards power generation.

Module-2

Thermal Comfort, Climate Analysis and Psychrometry: The 'human thermal comfort' lens and its implications for cooling system design, Progressive models for addressing human thermal comfort needs, Thermodynamics of human body, Factors affecting human comfort, Introduction to the ASHRAE Std. 55, Adaptive Comfort Model and the Indian Model for Adaptive Comfort (IMAC) and its implications for mitigating climate change and energy consumption from cooling technologies, Tools for predicting thermal comfort in buildings, Principles and tools for climate analysis, Composition of Psychrometric Charts, Psychrometric processes of conventional and sustainable cooling technologies and representation on psychrometric chart, Application of psychrometry to design conventional and sustainable cooling technologies.

Indoor Air Quality and Building Cooling Load Modelling:
Addressing trade-offs between indoor air quality requirements, daylighting needs, and solar heat gain reduction in artificially cooled buildings, Factors affecting building cooling loads, Building cooling load

Module-3

Refrigeration Systems and Refrigerants:
Thermodynamics of Vapor Compression Refrigeration (VCR) and Vapor Absorption Machine (VAM) Cycles, Equipment used in commercial and residential VCR and VAM systems, Physical, Chemical, Thermodynamic and Environmental properties of Refrigerants and Refrigerant mixtures (zeotropic and azeotropic mixtures) used in conventional VCR system, Absorbent – Refrigerant combinations (Water-Ammonia and Lithium-Bromide) used in VAM systems, Physical, Chemical, Thermodynamic and Environmental properties of emerging Natural Refrigerants for VCR systems.

Module-4

Air conditioning:
Air conditioning demand scenarios for India and associated health, social justice, energy access, and environmental Implications for its peoples and communities, Potential sustainable air conditioning scenarios for India, Heat transfer and psychrometric principles of air conditioning cycles, Engineering principles of air conditioning components, Air conditioning coefficient-of-performance calculation, Energy efficient air conditioning system, Energy and greenhouse gas emissions-based performance comparison of natural

refrigerant and f-gas based air conditioners.

Module-5

Sustainable Cooling Technologies:
Radical social justice fostering, energy conservation, and climate change mitigation potential of natural cooling, Design principles of natural and sustainable cooling systems, Science and engineering design principles of a) Direct, Indirect, and Hybrid (Direct-Indirect and DX) Evaporative Cooling technology, b) Structure Cooling, c) Radiant Cooling Systems, and d) Solar VAM technology, Basic equipment sizing calculations, System performance assessment methods, Comparative energy consumption, greenhouse gas emissions and life-cycle cost case studies for residential and commercial applications of conventional and sustainable cooling technologies.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Empathize with sustainable cooling as a means of enhancing social justice in India and mitigating climate change through their intellectual capabilities and ethical orientation

CO2: Compute and Interpret cooling and heating loads in a building and how they could be efficiently managed by using building energy modelling software

CO3: Estimate the performance of airconditioning systems using the principles of thermodynamics, heat transfer, and psychometry

CO4: Calculate and interpret the energy, cost, and greenhouse gas emissions performance of conventional and sustainable cooling technologies.

Co6: Conduct building and sustainable cooling modelling projects on a sophisticated building energy modelling software.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Refrigeration and Airconditioning	C P Arora	Tata McGraw Hill	3rd Edition
2	Heating, Ventilating and Airconditioning	Faye C McQuiston, Jerald D. Parker, Jeffrey D. Spitler	Wiley Indian Private Ltd.	
Reference Books				
1	Radiant Heating and Cooling Handbook	Richard D. Watson	McGraw-Hill Publication	2002
Link: https://www.accessengineeringlibrary.com/browse/radiant-heating-and-cooling-handbook#p2000a97e9970iii001				
2	Evaporative Cooling		CAREL	
Link: http://www.carel.com/-evaporative-cooling-book				

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B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII
Professional Elective 3

THEORYOF PLASTICITY

Course Code	**18ME743**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To introduce the concepts of Plasticity and mechanism of plastic deformation in metals.
- To expose the students to elasto-plastic problems involving plastic deformation of beams and bars.
- To introduce the concepts of slip line field theory.

Module-1

Brief review of fundamentals of elasticity: Concept of stress, stress invariants, principal Stresses, octahedral normal and shear stresses, spherical and deviatoric stress, stress transformation; concept of strain, engineering and natural strains, octahedral strain, deviator and spherical strain tensors, strain rate and strain rate tensor, cubical dilation, generalized Hooke's law, numerical problems.

Module-2

Plastic Deformation of Metals: Crystalline structure in metals, mechanism of plastic deformation, factors affecting plastic deformation, strain hardening, recovery, re crystallization and grain growth, flow figures or Luder's cubes.

Yield Criteria: Introduction, yield or plasticity conditions, Von Mises and Tresca criterion, geometrical representation, yield surface, yield locus (two-dimensional stress space), experimental evidence for yield

Module-3

Stress Strain Relations: Idealised stress-strain diagrams for different material models, empirical equations, Levy-Von Mises equation, Prandtl -Reuss and Saint Venant theory, experimental verification of Saint Venant's theory of plastic flow. Concept of plastic potential, maximum work hypothesis, mechanical work for deforming a plastic substance.

Module-4

Bending of Beams: Stages of plastic yielding, analysis of stresses, linear and nonlinear stress strain curve, problems.

Torsion of Bars: Introduction, plastic torsion of a circular bar, elastic perfectly plastic material, elastic work hardening of material, problems.

Module-5

Slip Line Field Theory: Introduction, basic equations for incompressible two-dimensional flows, continuity equations, stresses in conditions of plain strain, convention for slip lines, geometry of slip line field, properties of the slip lines, construction of slip line nets.

Course Outcomes: At the end of the course the student will be able to:

CO1: Understand stress, strain, deformations, relation between stress and strain and plastic deformation in solids.

CO2: Understand plastic stress-strain relations and associated flow rules.

CO3: Perform stress analysis in beams and bars including Material nonlinearity.

CO4: Analyze the yielding of a material according to different yield theory for a given state of stress.

CO5: Interpret the importance of plastic deformation of metals in engineering problems.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.

- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Theory of Plasticity	Chakraborty	Elsevier	3rd Edition
2	Theory of Plasticity and Metal forming Process	Sadhu Singh	Khanna Publishers, Delhi	
Reference Books				
1	Engineering Plasticity-Theory and Application to Metal Forming Process	R.A.C. Slater	McMillan Press Ltd.	
2	Basic Engineering Plasticity	DWA Rees	Elsevier	1st Edition
3	Engineering Plasticity	W. Johnson and P. B. Mellor	Van NoStrand Co. Ltd	2000
4	Advanced Mechanics of solids	L. S. Srinath	Tata Mc. Graw Hill	2009

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII
Professional Elective 3

MECHATRONICS

Course Code	**18ME744**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To acquire a strong foundation in science and focus in mechanical, electronics, control, software, and computer engineering, and a solid command of the newest technologies.
- To understand the evolution and development of Mechatronics as a discipline.
- To substantiate the need for interdisciplinary study in technology education
- To understand the applications of microprocessors in various systems and to know the functions of each element.
- To demonstrate the integration philosophy in view of Mechatronics technology
- To be able to work efficiently in multidisciplinary teams.

Module-1

Introduction: Scope and elements of mechatronics, mechatronics design process, measurement system, requirements and types of control systems, feedback principle, Basic elements of feedback control systems, Classification of control system. Examples of Mechatronics Systems such as Automatic Car Park system, Engine management system, Antilock braking system (ABS) control, Automatic washing machine.

Transducers and sensors: Definition and classification of transducers, Difference between transducer and sensor, Definition and classification of sensors, Principle of working and applications of light sensors, Potentiometers, LVDT, Capacitance sensors, force and pressure sensors, Strain gauges, temperature sensors, proximity switches and Hall Effect sensors.

Module-2

Signal Conditioning: Introduction – Hardware – Digital I/O, Analog to digital conversions, resolution, Filtering Noise using passive components – Registers, capacitors, amplifying signals using OP amps. Digital Signal Processing – Digital to Analog conversion, Low pass, high pass, notch filtering. Data acquisition systems (DAQS), data loggers, Supervisory control and data acquisition (SCADA), Communication methods.

Electro Mechanical Drives: Relays and Solenoids – Stepper Motors – DC brushed motors – DC brushless motors – DC servo motors – 4-quadrant servo drives, PWM's – Pulse Width Modulation.

Module-3

Microprocessor & Microcontrollers: Introduction, Microprocessor systems, Basic elements of control systems, Microcontrollers, Difference between Microprocessor and Microcontrollers.

Microprocessor Architecture: Microprocessor architecture and terminology-CPU, memory and address, I/O and Peripheral devices, ALU, Instruction and Program, Assembler, Data Registers, Program Counter, Flags, Fetch cycle, write cycle, state, bus interrupts. Intel's 8085A Microprocessor.

Module-4

Programmable Logic Controller: Introduction to PLCs, Basic structure of PLC, Principle of operation, input and output processing, PLC programming language, ladder diagram, ladder diagrams circuits, timer counters, internal relays, master control, jump control, shift registers, data handling, and manipulations, analogue input and output, selection of PLC for application.

Application of PLC control: Extending and retracting a pneumatic piston using latches, control of two pneumatic pistons, control of process motor, control of vibrating machine, control of process tank, control of conveyer motor etc.

Module-5

Mechatronics in Computer Numerical Control (CNC) machines: Design of modern CNC machines - Machine Elements: Different types of guide ways, Linear Motion guideways. Bearings: anti-friction bearings,

hydrostatic bearing and hydrodynamic bearing. Re-circulating ball screws. Typical elements of open and closed loop control systems. Adaptive controllers for machine tools.
Mechatronics Design process: Stages of design process – Traditional and Mechatronics design concepts – Case studies of Mechatronics systems – Pick and place Robot – Automatic car park barrier.

Course Outcomes: At the end of the course the student will be able to:

CO1: Illustrate various components of Mechatronics systems.

CO2: Assess various control systems used in automation.

CO3: Design and conduct experiments to evaluate the performance of a mechatronics system or component with
respect to specifications, as well as to analyse and interpret data.

CO4: Apply the principles of Mechatronics design to product design.

CO5: Function effectively as members of multidisciplinary teams.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Mechatronics-Principles Concepts and Applications	Nitaigour Premchand Mahalik	Tata McGraw Hill	1st Edition, 2003
2	Mechatronics–Electronic Control Systems in Mechanical and Electrical Engineering,	W.Bolton	Pearson Education	1stEdition, 2005
Reference Books				
1	Mechatronics	HMT Ltd	Tata Mc Graw Hill	1st Edition, 2000 ISBN:9780074636435
2	Mechatronics: Integrated Mechanical Electronic Systems	K.P. Ramachandran, G.K. Vijayaraghavan, M.S. Balasundaram.	Wiley India Pvt. Ltd. New Delhi	2008
3	Introduction to Mechatronics and Measurement Systems	David G. Aldatore, Michael B. Histand	McGraw-Hill Inc USA	2003
4	Introduction to Robotics: Analysis, Systems, Applications.	Saeed B. Niku,	Person Education	2006
5	Mechatronics System Design	Devdas Shetty, Richard A. kolk	Cengage publishers.	second edition

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII
Professional Elective 3

PROJECT MANAGEMENT

Course Code	**18ME745**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To understand how to break down a complex project into manageable segments and use of effective project management tools and techniques to arrive at solution and ensure that the project meets its deliverables and is completed within budget and on schedule.
- To impart knowledge on various components, phases, and attributes of a project.
- To prepare students to plan, develop, lead, manage, and successfully implement and deliver projects within their chosen practice area.

Module-1

Introduction: Definition of project, characteristics of projects, understand projects, types of projects, scalability of project tools, project roles Project Selection and Prioritization – Strategic planning process, Strategic analysis, strategic objectives, portfolio alignment – identifying potential projects, methods of selecting projects, financial mode / scoring models to select projects, prioritizing projects, securing and negotiating projects.

Module-2

Planning Projects: Defining the project scope, Project scope checklist, Project priorities, Work Breakdown Structure (WBS), Integrating WBS with organisation, coding the WBS for the information system. Scheduling Projects: Purpose of a project schedule, historical development, how project schedules are limited and created, develop project schedules, uncertainty in project schedules, Gantt chart.

Module-3

Resourcing Projects: Abilities needed when resourcing projects, estimate resource needs, creating staffing management plant, project team composition issues, Budgeting Projects: Cost planning, cost estimating, cost budgeting, establishing cost control. Project Risk Planning: Risk Management Planning, risk identification, risk analysis, risk response planning, Project Quality Planning and Project Kick off: Development of quality concepts, project quality management plan, project quality tools, kick off project, baseline and communicate project management plan, using Microsoft Project for project baselines.

Module-4

Performing Projects: Project supply chain management: - Plan purchasing and acquisitions, plan contracting, contact types, project partnering and collaborations, project supply chain management. 28 Project Progress and Results: Project Balanced Scorecard Approach, Internal project, customer, financial issues, Finishing the project: Terminate project early, finish projects on time, secure customer feedback and approval, knowledge management, perform administrative and contract closure.

Module-5

Network Analysis: Introduction, network construction - rules, Fulkerson's rule for numbering the events, AON and AOA diagrams; Critical path method (CPM) to find the expected completion time of a project, floats; PERTfor finding expected duration of an activity and project, determining the probability of completing a project, predicting the completion time of project; crashing of simple projects.

Course Outcomes: At the end of the course the student will be able to:

CO1: Understand the selection, prioritization and initiation of individual projects and strategic role of project management.

CO2: Understand the work breakdown structure by integrating it with organization.

CO3: Understand the scheduling and uncertainty in projects.

CO4: Understand risk management planning using project quality tools.

CO5: Understand the activities like purchasing, acquisitions, contracting, partnering and collaborations related to performing projects.

CO6: Determine project progress and results through balanced scorecard approach

CO7: Draw the network diagram to calculate the duration of the project and reduce it using crashing.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Project Management	Timothy J Kloppenborg	Cengage Learning	Edition 2009
2	Project Management -A systems approach to planning scheduling and controlling	Harold kerzner	CBS publication	
3	Project Management	S Choudhury	McGraw Hill Education (India) Pvt. Ltd. New Delhi	2016
Reference Books				
1	Project Management	Pennington Lawrence	Mc Graw Hill	
2	Project Management	A Moder Joseph and Phillips New Yark	Van Nostrand Reinhold	
3	Project Management,	Bhavesh M. Patal	Vikas publishing House	

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

Open Elective-B (Semester VII)

ENERGY AND ENVIRONMENT

Course Code	**18ME751**	CIE Marks	40
Teaching Hours / Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To understand the fundamentals of energy sources, energy use, energy efficiency, and resulting environmental implications of various energy supplies.
- To introduce various aspects of environmental pollution and its control.
- To understand the causes and remedies related to social issues like global warming, ozone layer depletion, climate change etc.
- To introduce various acts related to prevention and control of pollution of water and air, forest protection act, wild life protection act etc.

Module-1

Basic Introduction to Energy: Energy and power, forms of energy, primary energy sources, energy flows, world energy production and consumption, Key energy trends in India: Demand, Electricity, Access to modern energy, Energy production and trade, Factors affecting India's energy development: Economy and demographics Policy and institutional framework, Energy prices and affordability, Social and environmental aspects, Investment.

Module-2

Energy storage systems: Thermal energy storage methods, Energy saving, Thermal energy storage systems
Energy Management: Principles of Energy Management, Energy demand estimation, Energy pricing
Energy Audit: Purpose, Methodology with respect to process Industries, Characteristic method employed in Certain Energy Intensive Industries

Module-3

Environment: Introduction, Multidisciplinary nature of environmental studies- Definition, scope and importance, Need for public awareness.
Ecosystem: Concept, Energy flow, Structure and function of an ecosystem. Food chains, food webs and ecological pyramids, Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems, Ecological succession.

Module-4

Environmental Pollution: Definition, Cause, effects and control measures of - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and Nuclear hazards, Solid waste Management, Disaster management Role of an individual in prevention of pollution, Pollution case studies.

Module-5

Social Issues and the Environment: Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. Wasteland reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation.

Group assignments:
Assignments related to e-waste management; Municipal solid waste management; Air pollution control systems; Water treatment systems; Wastewater treatment plants; Solar heating systems; Solar power plants; Thermal power plants; Hydroelectric power plants; Biofuels; Environmental status assessments; Energy status assessments etc.
Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand energy scenario, energy sources and their utilization.

CO2: Understand various methods of energy storage, energy management and economic analysis.

CO3: Analyse the awareness about environment and eco system.

CO4: Understand the environment pollution along with social issues and acts.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education		University grant commission and Bharathi Vidyapeeth Institute of environment education and Research, Pune	
2	Energy Management Audit & Conservation- for Module 2	Barun Kumar De	Vrinda Publication	2nd Edition 2010
Reference Books				
1	Energy Management Hand book	Turner, W. C., Doty, S. and Truner, W. C	Fairmont Press	7^{th} Edition 2009
2	Energy Management	Murphy, W. R	Elsevier	2007
3	Energy Management Principles	Smith, C. B	Pergamum	2007
4	Environment pollution control Engineering	C S Rao	New Age International	reprint 2015, 2nd edition
5	Environmental studies	Benny Joseph	Tata McGraw Hill	2nd edition 2008

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

Semester VIII Open Elective B

AUTOMOTIVE ENGINEERING

Course Code	**18ME752**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To know layout and arrangement of principal parts of an automobile.
- To understand the working of transmission and brake systems.
- To comprehend operation and working of steering and suspension systems.
- To know the Injection system and its advancements.
- To know the automobile emissions and its effects on environment.

Module-1

ENGINE COMPONENTS AND IT'S PRINCIPLE PARTS: Spark Ignition (SI) & Compression Ignition (CI) engines, cylinder – arrangements and their relatives merits, Liners, Piston, connecting rod, crankshaft, valves, valve actuating mechanisms, valve and port timing diagrams, Types of combustion chambers for S.I.Engine and C.I.Engines, methods of a Swirl generation, engine positioning. Concept of HCCI engines, Hybrid engines, Twin spark engine, Electric car.

COOLING AND LUBRICATION: Cooling requirements, Types of cooling- Thermo siphon system, Forced circulation water cooling system, Water pump, Radiator, Significance of lubrication, Splash and Forced feed system.

Module-2

TRANSMISSION SYSTEMS: Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints. Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

BRAKES: Types of brakes, mechanical compressed air, vacuum and hydraulic braking systems, construction and working of master and wheel cylinder, brake shoe arrangements, Disk brakes, drum brakes, Antilock – Braking systems, purpose and operation of antilock-braking system, ABS Hydraulic Unit, Rear-wheel antilock, & Numerical.

Module-3

STEERING AND SUSPENSION SYSTEMS: Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Suspension, Torsion bar suspension systems, leaf spring, coil spring, independent suspension for front wheel and rear wheel, Air suspension system.

IGNITION SYSTEM: Battery Ignition system, Magneto Ignition system, electronic Ignition system.

Module-4

SUPERCHARGERS AND TURBOCHARGERS: Naturally aspirated engines, Forced Induction, Types of superchargers, Turbocharger construction and operation, Intercooler, Turbocharger lag.

FUELS, FUEL SUPPLY SYSTEMS FOR SI AND CI ENGINES: Conventional fuels, Alternative fuels, Normal and Abnormal combustion, Cetane and Octane numbers, Fuel mixture requirements for SI engines, Types of carburetors, C.D.& C.C. carburettors, Multi point and Single point fuel injection systems, fuel transfer pumps, Fuel filters, fuel injection pumps and injectors. Electronic Injection system, Common Rail Direct Injection System.

Module-5

AUTOMOTIVE EMISSION CONTROL SYSTEMS: Different air pollutants, formation of photochemical smog and causes. Automotive emission controls, Controlling crankcase emissions, Controlling evaporative emissions, Cleaning the exhaust gas, Controlling the air-fuel mixture, Controlling the combustion process, Exhaust gas recirculation, Treating the exhaust gas, Air-injection system, Air-aspirator system, Catalytic converter.
EMISSION STANDARDS: Euro I, II, III and IV norms, Bharat Stage II, III, IV norms. Motor Vehicle Act.

Course Outcomes: At the end of the course, the student will be able to:

- Identify the different parts of an automobile and it's working.
- Understand the working of transmission and braking systems.
- Understand the working of steering and suspension systems and their applications.
- Selection and applications of various types of fuels and injection systems.
  Analyse the cause of automobile emissions, its effects on environment and methods to reduce the emissions.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Automobile engineering Vol I and II	Kirpal Singh	Standard Publishers	12th Edition 2011
2	Automotive Mechanics	S. Srinivasan	Tata McGraw Hill	2003 2nd Edition
Reference Books				
1	Automotive Mechanics	William H Crouse & Donald L Anglin	Tata McGraw Hill Publishing Company	10th Edition 2007
2	Automotive Mechanics: Principles and Practices,	Joseph Heitner	D Van Nostrand Company, Inc	
3	Automobile Engineering	R. B. Gupta	Satya Prakashan	4th edition 1984.
4	Fundamentals of Automobile Engineering	K.K.Ramalingam	Scitech Publications (India) Pvt. Ltd	

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

Semester VII Open Elective-B

INDUSTRIAL SAFETY

Course Code	**18ME753**	CIE Marks	40
Teaching Hours / Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- The present course highlights the importance of general safety and its prevention.
- It enables students to understand about mechanical, electrical sand chemical safety.
- The Industrial safety course helps in motivating the students to understand the reason for fire
- Its Controlling of fire by various means are highlighted.
- Importance of chemical safety, labelling of chemicals, hand signals during forklift operations in industrial and aerodromes will help in to understand and apply the techniques in practical field.
- A visit to campus, various labs, workshops, local industries and fire stations helps in analyzing the importance of safety and corrective measures through case studies.

Module-1

Terms used: accident, safety, hazard, safe, safety devices, safety guard, security, precaution, caution, appliance, slip, trip, fall. Ladders and scaffolding. Unsafe acts, reason for accidents, MSDS (material safety data sheet), computer Aided Hazard Analysis, International acts and standards OSHA, WHO. Environment act, control and abatement of environmental pollution-Biomedical waste. Lockout and tag out procedures. Safe material handling and storage. Risk analysis quantification.

Case studies: Student should identify the unsafe acts near their surroundings like housekeeping, lab as well as industrial layouts, road safety, campus layout, safety signs.

Module-2

Introduction, toxicity of products of combustion – vapour clouds – flash fire – jet fires – pool fires – auto-ignition, sources of ignition . Class A, B, C, D and E fire. Fire triangle, Fire extinguishers, Fire hazard and analysis, prevention of fire. Fire protection and loss prevention, steps after occurrence of fire. notice-first aid for burns, Portable fire extinguishers. Fire detection, fire alarm and firefighting systems. Safety sign boards, instruction on portable fire extinguishers. Case studies: demonstration of fire extinguishers, visit to local fire fighting stations. Visit to fire accident sites to analyze the cause of fire and its prevention for future.

Module-3

PPE, safety guards, Mechanical hazards, workplace hazards, Forklift hazard control Safety while working with machine tools like lathe, drill press, power and band saws, grinding machines. Safety during welding, forging and pressing. Safety while handling Material, compressed gas cylinders, corrosive substance, waste drum and containers.

Case studies: Visit to machine shop, workshops, foundry lab and local industries to record the practical observation and report the same with relevant figures and comments.

Module-4

Introduction to electrical safety, Indian standards on electrical safety, Electric hazards, effect of electric current on human body, causes of electrical accidents, prevention of electric accidents, PPE used. Protection systems: Fuse, circuit breakers and overload relays – protection against over voltage and under voltage. Electric shock. Primary and secondary electric shocks, AC and DC current shocks. Safety precautions against shocks. Safety precautions in small and residential building installations. Safety procedures in electric plant.

Case studies: To visit electrical sub stations, local distribution systems, observe and share the experience and report.

Module-5

Introduction to Chemical safety, Labelling of chemicals, acid hoods. Handling of acids, eye washers and showers. Safety thinking, accident investigation, safety policy of the company, safety, loss prevention and control, check list for LPG installations, safety precautions using CNG, fire prevention and safety audit, confined space entry, risk assessment.

Case studies: To visit chemical laboratory of the college and other chemical industries like LPG , CNG facilities and report.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand the basic safety terms and international standards.

CO2: Identify the hazards and risk analysis around the work environment and industries.

CO3: Use the safe measures while performing work in and around the work area of the available laboratories. Able to recognize the sign boards and its application

CO4: Recognise the types of fires extinguishers and to demonstrate the portable extinguishers used for different classes of fires.

CO5: Report the case studies by sharing experience of the employees working in housekeeping, laboratories like workshops, electrical labs, machine shops, electronics and computer laboratories.

CO6: Recognise the chemical and electrical hazards for its prevention and control.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Industrial Safety and Management	L M Deshmukh	McGraw Hill Education (India) private Limited	ISBN-13: 978-0-07-061768-1
2	Fire Prevention Hand Book	Derek, James	Butter Worth's and Company, London	1986
3	Electrical Safety, fire safety and safety management	S.Rao, R K Jain and Saluja	Khanna Publishers	ISBN: 978-81-7409-306-6
4	Industrial health and safety management	A.M.Sarma	Himalya publishing house	
5	Chemical process Industrial safety	K S N Raju	McGraw Hill Education (India) private Limited.	ISBN-13: 978-93-329-0278-7
6	Environmental engineering	Gerard Kiely	McGraw Hill Education (India) private Limited	ISBN-13: 978-0-07-063429-9
Reference Books				
1	The Environment Act (Protection) 1986	Commercial Law Publishers (India) Pvt. Ltd. New Delhi.		
2	Water (Prevention and control of pollution) act 1974	Commercial Law publishers (India)		

		Pvt. Ltd., New Delhi.		

- To visit respective Institution: stores, office, housekeeping area, laboratories.
- To visit local industries, workshops, district firefighting system facility and local electrical power stations.

[Updated /Corrected on 23.08.2021]

OPEN ELECTIVE B **B. E. MECHANICAL ENGINEERING** Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER – VII			
OPTIMISATION TECHNIQUES			
Course Code	**18ME754**	CIE Marks	40
Teaching Hours / Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To expose the students to techniques to optimize complex engineering problems.
- To introduce non-linear programming techniques.
- To introduce the Integer programming method.

Module-1

Introduction: Statement of optimisation problem, Design vector, Design constraints, Objective function, Classification of optimisation problems based on :constraints, nature of design variables, nature of the equations involved

Single variable optimisation: Necessary and sufficient conditions, Multivariable optimization with no constraints: Necessary and sufficient conditions, Semi definite case, Saddle point, Multi variable optimization with equality constraints, Solution by direct substitution, Lagrange Multipliers, Interpretation of Lagrange multipliers, Multivariable optimization with inequality constraints: Khun Tucker conditions(concept only).

Module-2

Nonlinear Programming: One-Dimensional Minimization Methods**,** Introduction, Unimodal Function, Elimination methods: unrestricted search, fixed step size, accelerated step size, Exhaustive search: dichotomous search, interval halving method, Fibonacci method, golden section method, Interpolation methods: Quadratic and cubic interpolation method, direct root method, Newton method, Quasi-Newton method, secant method.

Module-3

Nonlinear Programming: Direct search methods: Classification of unconstrained minimization methods, rate of convergence, scaling of design variables, random search methods, univariate methods, pattern directions, Powell's methods, Simplex method.

Module-4

Nonlinear Programming: Indirect Search (Descent) Methods: Gradient of a function, Steepest decent method, Fletcher Reeves method, Newton's method, Davidson-Fletcher-Powell method.

Module-5

Integer Programming: Introduction, Graphical representation, Gomory's cutting plane method: concept of a cutting plane, Gomory's method for all-integer programming problems, Bala's algorithm for zero–one programming, Branch-and-Bound Method.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Define and use optimization terminology, concepts, and understand how to classify an optimization problem.

CO2: Understand how to classify an optimization problem.

CO3: Apply the mathematical concepts formulate the problem of the systems.

CO4: Analyse the problems for optimal solution using the algorithms.

CO5: Interpret the optimum solution.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Engineering Optimization Theory and Practice	S. S. Rao	John Wiley & Sons	Fourth Edition 2009
2	Optimisation Concepts and Applications in Engineering	A. D. Belegundu, T.R. Chanrupatla,	Cambridge University Press	2011
Reference Books				
1	Engineering Optimization: Methods and Applications	Ravindran, K. M. Ragsdell, and G. V. Reklaitis	Wiley, New York	2nd ed. 2006

B. E. MECHANICAL ENGINEERING **Choice Based Credit System (CBCS) and Outcome Based Education (OBE)** **SEMESTER - VII**			
COMPUTRE AIDED MANUFACTURING LAB			
Course Code	**18MEL76**	CIE Marks	40
Teaching Hours /Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To expose the students to the techniques of CNC programming and cutting tool path generation through CNC simulation software by using G-Codes and M-codes.
- To educate the students on the usage of CAM packages.
- To make the students understand the importance of automation in industries through exposure to FMS, Robotics, and Hydraulics and Pneumatics.

Sl. No.	Experiments
	PART - A
1	**Manual CNC part programming** using ISO Format G/M codesfor 2 turning and 2 milling parts. Selection and assignment of tools, correction of syntax and logical errors, and verification of tool pathusing CNC program verification software.
	PART - B
2	**CNC part programming using CAM packages**. Simulation of Turning, Drilling, Milling operations. 3 typical simulations to be carried out using simulation packages like: **CademCAMLab-Pro, Master-CAM.** Program generation using software. Optimize spindle power, torque utilization, and cycle time. Generation and printing of shop documents like process and cycle time sheets, tool list, and tool layouts. Cut the part in single block and auto mode and measure the virtual part on screen. **Post processingof CNC programs** for standard CNC control systems like **FANUC, SINUMERIC and MISTUBISHI.**
	PART - C
3	**(Only for Demo/Viva voce)** **FMS (Flexible Manufacturing System)**: Programming of Automatic storage and Retrieval system (ASRS) and linear shuttle conveyor Interfacing CNC lathe, milling with loading unloading arm and ASRS to be carried out on simple components. **Robot programming:** Using Teach Pendent & Offline programming to perform pick and place, stacking of objects (2 programs). **Pneumatics and Hydraulics, Electro-Pneumatics:** 3 typical experiments on Basics of these topics to be conducted.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.

Scheme of Examination:

One question from Part A: 40 marks

One question from Part B: 40 Marks

Viva voce: 20 Marks

Total: 100 Marks

Updated on 16.04.2020/28092020

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

DESIGN LAB

Course Code	**18MEL77**	CIE Marks	40
Teaching Hours /Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To understand the concepts of natural frequency, logarithmic decrement, damping and damping ratio.
- To understand the techniques of balancing of rotating masses.
- To verify the concept of the critical speed of a rotating shaft.
- To illustrate the concept of stress concentration using Photo elasticity.
- To appreciate the equilibrium speed, sensitiveness, power and effort of a Governor.
- To illustrate the principles of pressure development in an oil film of a hydrodynamic journal bearing.

Sl. No.	Experiments
	PART - A
1	Determination of natural frequency, logarithmic decrement, damping ratio and damping coefficient in a single degree of freedom vibrating systems (longitudinal and torsional).
2	Balancing of rotating masses
3	Determination of critical speed of a rotating shaft
4	Determination of equilibrium speed, sensitiveness, power and effort of Porter/Proell /Hartnel Governor.
	PART - B
5	Determination of Fringe constant of Photo-elastic material using. a) Circular disc subjected to diametral compression. b) Pure bending specimen (four-point bending.
6	Determination of stress concentration using Photo-elasticity for simple components like plate with a hole under tension or bending, circular disk with circular hole under compression, 2D Crane hook
7	Determination of Pressure distribution in Journal bearing
8	Determination of Principal Stresses and strains in a member subjected to combined loading using Strain
9	Determination of stresses in Curved beam using strain gauge.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Compute the natural frequency of the free and forced vibration of single degree freedom systems, critical speed of shafts.

CO2: Carry out balancing of rotating masses.

CO3: Analyse the governor characteristics.

CO4: Determine stresses in disk, beams, plates and hook using photo elastic bench.

CO5: Determination of Pressure distribution in Journal bearing

CO6: Analyse the stress and strains using strain gauges in compression and bending test and stress distribution in curved beams.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.

Scheme of Examination:
One question from Part A: 40 marks One question from Part B: 40 Marks Viva voce: 20 Marks Total: 100 Marks

B. E. MECHANICAL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VIII			
ENERGY ENGINEERING			
Course Code	**18ME81**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- Understand energy scenario, energy sources and their utilization
- Learn about energy conversion methods
- Study the principles of renewable energy conversion systems.

Module-1

STEAM GENERATORS Coal and ash handling, Generation of steam using forced circulation, high and supercritical pressures, LaMount, Benson, Velox, Loeffer, Schmidt steam generators, Cooling towers and Ponds, Accessories such as Superheaters, De-superheater, Economizers, Air preheaters.

Module-2

Solar Energy: Introduction, Solar radiation at the earth's surface, Solar radiation measurements, Flat plate collectors, Focussing collectors, Solar pond, Solar electric power generation-Solar photovoltaics.

Biomass Energy: Photosynthesis, photosynthetic oxygen production, energy plantation. Bio Chemical Route: Biogas production from organic wastes by anaerobic fermentation, Bio gas plants-KVIC, Janta, Deenbhandu models, factors affecting bio gas generation. Thermal gasification of biomass, updraft and downdraft

Module-3

Geothermal Energy: Forms of geothermal energy, Dry steam, wet steam, hot dry rock and magmatic chamber systems.

Tidal Energy: Tidal power, Site selection, Single basin and double basin systems, Advantages and disadvantages of tidal energy.

Wind Energy: Wind energy-Advantages and limitations, wind velocity and wind power, Basic components of wind energy conversion systems, horizontal and vertical axis wind mills, coefficient of performance of a wind mill rotor, Applications of wind energy.

Module-4

Hydroelectric plants: Advantages & disadvantages of water power, Hydrographs and flow duration curves-numericals, Storage and pondage, General layout of hydel power plants- components such as Penstock, surge tanks, spill way and draft tube and their applications, pumped storage plants, Detailed classification of hydroelectric plants, water hammer.

Ocean Thermal Energy: Ocean thermal energy conversion, Principle and working of Rankine cycle, Problems associated with OTEC.

Module-5

NUCLEAR ENERGY Principles of release of nuclear energy-Fusion and fission reactions. Nuclear fuels used in the reactors, Chain reaction, Moderation, breeding, Multiplication and thermal utilization factors. General components of a nuclear reactor and materials, Brief description-Pressurized water reactor, Boiling water reactor, Sodium graphite reactor, Fast Breeder reactor, Homogeneous graphite reactor and gas cooled reactor, Radiation hazards, Shielding, Nuclear waste, Radioactive waste disposal.

Course Outcomes: At the end of the course the student will be able to:

CO1: Understand the construction and working of steam generators and their accessories.

CO2: Identify renewable energy sources and their utilization.

CO3: Understand principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, nuclear, hydel and tidal.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Power Plant Engineering	P. K. Nag	Tata McGraw Hill Education Private Limited, New Delhi	Third Edition, 2012.
2	Power Plant Engineering	Arora and Domkundwar	Dhanpat Rai & Co. (P) Ltd.	Sixth Edition, 2012.
3	Non-conventional Sources of Energy	G.D.Rai	Khanna Publishers, New Delhi	Fifth Edition, 2015.
4	Non-conventional energy resources	B H Khan	McGraw Hill Education	3rd Edition
Reference Books				
1	Power Plant Engineering	R. K. Rajput	Laxmi publication New Delhi	
2	Principles of Energy conversion	A. W. Culp Jr	McGraw Hill	1996
3	Power Plant Technology	M.M. EL-Wakil	McGraw Hill International	1994
4	Solar Energy: principles of Thermal Collection and Storage	S.P. Sukhatme	Tata McGraw-Hill	1984

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VIII
Professional Elective-4

CNC MACHINE TOOLS

Course Code	**18ME821**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To understand fundamentals of the CNC technology.
- To get exposed to constructional features of CNC machine tools.
- To know the concepts of CNC machine tool drives and feedback systems.
- To understand the programming methods in CNC machines.
- To understand the cutting tools used, and work holding devices on CNC machine tools.

Module-1

INTRODUCTION TO CNC MACHINE TOOLS: Evolution of CNC Technology, principles, features, advantages, applications, CNC and DNC concept, classification of CNC Machines – turning centre, machining centre, grinding machine, EDM, types of control systems, CNC controllers, characteristics, interpolators– Computer Aided Inspection.

Module-2

STRUCTURE OF CNC MACHINE TOOL: CNC Machine building, structural details, configuration and design, guide ways – Friction, Anti friction and other types of guide ways, elements used to convert the rotary motion to a linear motion – Screw and nut, recirculating ball screw, planetary roller screw, recirculating roller screw, rack and pinion, spindle assembly, torque transmission elements – gears, timing belts, flexible couplings, Bearings.

Module-3

DRIVES AND CONTROLS: Spindle drives – DC shunt motor, 3 phase AC induction motor, feed drives –stepper motor, servo principle, DC and AC servomotors, Open loop and closed loop control, Axis measuring system – synchro, synchro-resolver, gratings, moiré fringe gratings, encoders, inductosysn, laser interferometer.

Module-4

CNC PROGRAMMING: Coordinate system, structure of a part program, G & M Codes, tool length compensation, cutter radius and tool nose radius compensation, do loops, subroutines, canned cycles, mirror image, parametric programming, machining cycles, manual part programming for machining centre and turning centre.

Computer Aided CNC Part Programming: Need for computer aided part programming, Tools for computer aided part programming, APT, CAD/CAM based part programming for well-known controllers such as Fanuc, Heidenhain, Sinumerik etc., and generation of CNC codes from CAM packages.

Module-5

TOOLING AND WORK HOLDING DEVICES: Introduction to cutting tool materials – Carbides, Ceramics, CBN, PCD–inserts classification, qualified, semi qualified and pre-set tooling, tooling system for Machining centre and Turning centre, work holding devices for rotating and fixed work parts, modular fixtures, economics of CNC, maintenance of CNC machines.

Course Outcomes: At the end of the course the student will be able to:

CO1: Understand evolution, classification and principles of CNC machine tools.

CO2: Learn constructional details of CNC machine tools, selection of standard components used for CNC machine tools for accuracy and productivity enhancement.

CO3: Select drives and positional transducers for CNC machine tools.

CO4: Apply CNC programing concepts of for two axis turning centers and three axis vertical milling centers to generate programs different components.

CO5: Generate CNC programs for popular CNC controllers.

CO6: Analyse and select tooling and work holding devices for different components to be machined on CNC machine tools.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Mechatronics	HMT	Tata McGraw-Hill Publishing Company Limited, New Delhi	2005
2	Computer Control of Manufacturing systems	Koren Y	McGraw Hill	1986
3	Computer Numerical Control Machines	Radhakrishnan P	New Central Book Agency	2002
Reference Books				
1	CNC Machining Hand Book	James Madison	Industrial Press Inc	1996
2	Programming of CNC Machines	Ken Evans, John Polywka& Stanley Gabrel	Industrial Press Inc, New York	Second Edition2002
3	CNC Programming Hand book	Peter Smid	Industrial Press Inc	2000
4	CAD/CAM	Rao P.N.	Tata McGraw-Hill Publishing Company Limited	2002
5	Computer Numerical Control	Warren S. Seames	Thomson Delmar	Fourth Edition 2002

B. E. MECHANICAL ENGINEERING **Choice Based Credit System (CBCS) and Outcome Based Education (OBE)** **SEMESTER - VIII** **Professional Elective-4**			
TRIBOLOGY			
Course Code	**18ME822**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To educate the students on the importance of friction, the related theories/laws of sliding and rolling friction and the effect of viscosity of lubricants.
- To expose the students to the consequences of wear, wear mechanisms, wear theories and analysis of wear problems.
- To make the students understand the principles of lubrication, lubrication regimes, theories of hydrodynamic and the advanced lubrication techniques.
- To expose the students to the factors influencing the selection of bearing materials for different sliding applications.
- To introduce the concepts of surface engineering and its importance in tribology.

Module-1

Introduction to tribology: Historical background, practical importance, and subsequent use in the field.
Lubricants: Types and specific field of applications. Properties of lubricants, viscosity, its measurement, effect of temperature and pressure on viscosity, lubrication types, standard grades of lubricants, and selection of lubricants.

Module-2

Friction: Origin, friction theories, measurement methods, friction of metals and non-metals.
Wear: Classification and mechanisms of wear, delamination theory, debris analysis, testing methods and standards. Related case studies.

Module-3

Hydrodynamic journal bearings: Friction forces and power loss in a lightly loaded journal bearing, Petroff's equation, mechanism of pressure development in an oil film, and Reynold's equation in 2D.
Introduction to idealized journal bearing, load carrying capacity, condition for equilibrium, Sommerfeld's number and it's significance; partial bearings, end leakages in journal bearing, numerical examples.

Module-4

Plane slider bearings with fixed/pivoted shoe: Pressure distribution, Load carrying capacity, coefficient of friction, frictional resistance in a fixed/pivoted shoe bearing, center of pressure, numerical examples.
Hydrostatic Lubrication: Introduction to hydrostatic lubrication, hydrostatic step bearings, load carrying capacity and oil flow through the hydrostatic step bearing, numerical examples. Introduction to Hydrostatic journal bearings.

Module-5

Bearing Materials: Commonly used bearings materials, and properties of typical bearing materials. Advantages and disadvantages of bearing materials.
Introduction to Surface engineering: Concept and scope of surface engineering.
Surface modification – transformation hardening, surface melting, thermo chemical processes.
Surface Coating – plating, fusion processes, vapor phase processes. Selection of coating for wear and corrosion resistance.

Course Outcomes: At the end of the course, the student will be able to:
CO1: Understand the fundamentals of tribology and associated parameters.
CO2: Apply concepts of tribology for the performance analysis and design of components experiencing relative

motion.

CO3: Analyse the requirements and design hydrodynamic journal and plane slider bearings for a given application.

CO4: Select proper bearing materials and lubricants for a given tribological application.

CO5: Apply the principles of surface engineering for different applications of tribology.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Introduction to Tribology	B. Bhushan	John Wiley & Sons, Inc., New York	2002
2	Engineering Tribology	Prasanta Sahoo	PHI Learning Private Ltd, New Delhi	2011
3	Engineering Tribology	J. A. Williams	Oxford Univ. Press	2005
Reference Books				
1	Introduction to Tribology in bearings	B. C. Majumdar	Wheeler Publishing	
2	Engineering Tribology	G. W. Stachowiak and A. W. Batchelor	Butterworth-Heinemann	1992
3	Friction and Wear of Materials	Ernest Rabinowicz	John Wiley &Sons	1995
4	Basic Lubrication Theory	A. Cameron	Ellis Hardwoods Ltd., UK	
5	Handbook of tribology: materials, coatings and surface treatments	B.Bhushan, B.K. Gupta	McGraw-Hill	1997

B. E. MECHANICAL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VIII Professional Elective-4			
NON-DESTRUCTIVE TESTINGAND EVALUATION			
Course Code	**18ME823**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To introduce the basic principles, techniques, equipment, applications and limitations of Non-Destructive Testing (NDT) methods such as Visual, Penetrant Testing, Magnetic Particle Testing, Ultrasonic Testing, Radiography, Eddy Current.
- To enable selection of appropriate NDT methods.
- To identify advantages and limitations of NDT methods
- To make aware the developments and future trends in NDT.

Module-1

OVERVIEW OF NDT: NDT Versus Mechanical testing, Overview of the Non-Destructive Testing Methods for the detection of manufacturing defects as well as material characterisation. Relative merits and limitations, Various physical characteristics of materials and their applications in NDT. Visual inspection – Unaided and aided.

Module-2

SURFACE NDT METHODS: Liquid Penetrant Testing – Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods, Testing Procedure, Interpretation of results. Magnetic Particle Testing- Theory of magnetism, inspection materials, magnetization methods, Interpretation and evaluation of test indications, Principles and methods of demagnetization, Residual magnetism.

Module-3

THERMOGRAPHY AND EDDY CURRENT TESTING (ET): Thermography- Principles, Contact and non -contact inspection methods, Techniques for applying liquid crystals, Advantages and limitation – infrared radiation and infrared detectors, Instrumentations and methods, applications. Eddy Current Testing-Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation.

Module-4

ULTRASONIC TESTING (UT) AND ACOUSTIC EMISSION (AE):
Ultrasonic Testing-Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A/Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight Diffraction. Acoustic Emission Technique –Principle, AE parameters, Applications.

Module-5

RADIOGRAPHY (RT): Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse square, law, characteristics of films – graininess, density, speed, contrast, characteristic curves, Penetrameters, Exposure charts, Radiographic equivalence. Fluoroscopy- Xero-Radiography, Computed Radiography, Computed Tomography.

Course Outcomes: At the end of the course the student will be able to:
CO1: Classify various 144on-destructive testing methods.
CO2: Check different metals and alloys by visual inspection method.
CO3: Explain and perform non-destructive tests like: Liquid penetrant test, Magnetic particle test, Ultrasonic test, X- ray and Gamma ray radiography, Leak Test, Eddy current test.
CO4: Identify defects using relevant NDT methods.
CO5: Differentiate various defect types and select the appropriate NDT methods for betterevaluation.

CO6: Document the testing and evaluation of the results.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Practical Non-Destructive Testing	Baldev Raj, T.Jayakumar, M.Thavasimuthu	Narosa Publishing House	2009
2	Non-Destructive Testing Techniques	Ravi Prakash	New Age International Publishers	1st revised edition2010
Reference Books				
1	ASM Metals Handbook,"Non-Destructive Evaluation and Quality Control", Volume-17	American Society of Metals,	Metals Park, Ohio, USA,	2000
2	Introduction to Non-destructive testing: a training guide	Paul E Mix,	Wiley	2nd Edition New Jersey, 2005
3	Handbook of Nondestructive evaluation	Charles, J. Hellier	McGraw Hill, New York	2001

ASNT, American Society for Non Destructive Testing, Columbus, Ohio, NDT Handbook,Vol. 1, Leak Testing, Vol. 2, Liquid Penetrant Testing, Vol. 3, Infrared and Thermal Testing Vol. 4, Radiographic Testing, Vol. 5, Electromagnetic Testing, Vol. 6, Acoustic Emission Testing, Vol. 7, Ultrasonic Testing.

B.E, VIII Semester, Mechanical Engineering Choice Based Credit System (CBCS) and Outcome Based Education (OBE) (Effective from the academic year 2018-19)			
Professional Elective-IV AUTOMOBILE ENGINEERING			
Course Code	**18ME824**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- The layout and arrangement of principal parts of an automobile
- The working of transmission and brake systems
- The operation and working of steering and suspension systems
- To know the Injection system and its advancements
- To know the automobile emissions and its effects on environment

Module - 1

ENGINE COMPONENTS AND IT'S PRINCIPLE PARTS: Spark Ignition (SI) & Compression Ignition (CI) engines, cylinder – arrangements and their relatives merits, Liners, Piston, connecting rod, crankshaft, valves, valve actuating mechanisms, valve and port timing diagrams, Types of combustion chambers for S.I.Engine and C.I.Engines, methods of a Swirl generation, choice of materials for different engine components, engine positioning. Concept of HCCI engines, hybrid engines, twin spark engine, electric car. **COOLING AND LUBRICATION**: cooling requirements, types of cooling- thermo siphon system, forced circulation water cooling system, water pump, Radiator, thermostat valves. Significance of lubrication, splash and forced feed system.

Module - 2

TRANSMISSION SYSTEMS: Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints,Differential and rear axle, Hotchkiss Drive and Torque Tube Drive. BRAKES: Types of brakes, mechanical compressed air, vacuum and hydraulic braking systems, construction and working of master and wheel cylinder, brake shoe arrangements, Disk brakes, drum brakes, Antilock –Braking systems, purpose and operation of antilock-braking system, ABS Hydraulic Unit, Rear-wheel antilock & Numerical

Module - 3

STEERING AND SUSPENSION SYSTEMS: Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Suspension, Torsion bar suspension systems, leaf spring, coil spring, independent suspension for front wheel and rear wheel, Air suspension system. IGNITION SYSTEM: Battery Ignition system, Magneto Ignition system, electronic Ignition system

Module - 4

SUPERCHARGERS AND TURBOCHARGERS: Naturally aspirated engines, Forced Induction, Types of superchargers, Turbocharger construction and operation, Intercooler, Turbocharger lag.
FUELS, FUEL SUPPLY SYSTEMS FOR SI AND CI ENGINES: Conventional fuels, alternative fuels,

normal and abnormal combustion, cetane and octane numbers, Fuel mixture requirements for SI engines, types of carburetors, C.D.& C.C. carburetors, multi point and single point fuel injection systems, fuel transfer pumps, Fuel filters, fuel injection pumps and injectors. Electronic Injection system, Common Rail Direct Injection System

Module - 5

AUTOMOTIVE EMISSION CONTROL SYSTEMS: Different air pollutants, formation of photochemical smog and causes. Automotive emission controls, controlling crankcase emissions, controlling evaporative emissions, Cleaning the exhaust gas, Controlling the air-fuel mixture, Controlling the combustion process, Exhaust gas recirculation, Treating the exhaust gas, Air-injection system, Air-aspirator system, Catalytic converter.

EMISSION STANDARDS: Euro I, II, III and IV norms, Bharat Stage II, III, IV norms. Motor Vehicle Act

Course Outcomes:

- To identify the different parts of an automobile and it's working
- To understand the working of transmission and braking systems
- To comprehend the working of steering and suspension systems
- To learn various types of fuels and injection systems
- To know the cause of automobile emissions, its effects on environment and methods to reduce the emissions.

TEXT BOOKS:

1. Automobile engineering, Kirpal Singh, Vol I and II (12th Edition) Standard Publishers 2011
2. Automotive Mechanics, S. Srinivasan, (2nd Edition) Tata McGraw Hill 2003.

REFERENCE BOOKS

1. Automotive mechanics, William H Crouse & Donald L Anglin (10th Edition) Tata McGraw Hill Publishing Company Ltd., 2007.
2. Automotive mechanics: Principles and Practices, Joseph Heitner, D Van Nostrand Company, Inc
3. Fundamentals of Automobile Engineering, K.K.Ramalingam, Scitech Publications (India) Pvt. Ltd.
4. Automobile Engineering, R. B. Gupta, SatyaPrakashan,(4th Edition) 1984.

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VIII
Professional Elective-4

TOOL DESIGN

Course Code	**18ME825**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To develop capability to design and select single point and multipoint cutting tools for various machining operations.
- Exposure to variety of locating and clamping methods available.
- To enable the students to design jigs and fixtures for simple components.
- To expose the students to the design/selection procedure of press tools and die casting dies**.**

Module-1

Introduction to tool design: Tooling, requirements of a tool designer, general tool design procedure, tool engineering functions and its importance to enhance productivity and quality.
Review of cutting tool materials. Tool angles and signature, Carbide inserts grades - ISO designation and applications, tool holders for turning-ISO designation. Solid type tool, brazed tip tool, throwaway indexable insert types, coated carbides and chip breakers.
Design of single point cutting tools: Design of shank dimensions using strength and rigidity considerations for rectangular, square and round cross section and selection of tool geometry.

Module-2

Design of Multi Point Cutting Tools: Types of drills, Drill bit design - elements like back taper, web thickness, land width, margin, flute length and cross section and selection of tool geometry. Re-sharpening of drill bit.
Tool holders for milling, different tapers used for mounting tool holders in milling, ISO designation. Tool mounting systems.
Design of milling cutters: Design of elements like number of teeth and height, circular pitch, body thickness, chamfer width, fillet radius and selection of tool geometry. Profile sharpened and form relieved milling cutters. Re-sharpening of side and face milling cutter and end mill.

Module-3

Jigs and Fixtures: Functions and differences between jigs and fixtures, advantages in mass production, design principles, economics of jigs and fixtures.
Location: 3-2-1 Principle of location, different types of locating elements.
Clamping: Principles of clamping, types of clamping devices, and power clamping.
Drill bushes;
Drill jigs: Different types, exercises of designing jigs for simple components.
Fixture Design: Turning fixtures, milling fixtures, grinding fixtures, fixturing for CNC machining centers, and modular fixtures. Design exercises on fixtures for turning and milling for simple components

Module-4

Press tools: Classification and working of power presses. Concept and calculations of press tonnage and shut height of a press, components of a simple die, press tool operation, die accessories, shearing action in punch & die, clearance, shear on punch and die, Centre of pressure, and strip layout.
Simple, progressive, compound, combination and inverted dies. Design problems on blanking and piercing dies for simple components.
Bending dies – Introduction, bend allowance, spring back, edge bending die design.

Module-5

Drawing dies – Single action, double action and triple action dies, factors affecting drawing and drawing die design. Design of drawing dies for simple components.

Die casting: Die casting alloys, terminology- core, cavity, sprue, slug, fixed and movable cores, finger cams, draft, ejector pins and plates, gate, goose nozzle, over-flow, platten, plunger, runner, vent, water-line etc.
Types of Dies: Single cavity, multi cavity dies, combination dies, unit dies, advantages and disadvantages of types of dies; finishing, trimming and inspection of die casting components, safety, and modern trends in die casting dies.

Assignment:
Course work includes a **ToolDesign project**. Tool design project should enable the students to design a tooling like Jig or a fixture for a simple component, fixture for a simple component on CNC machining centers, design of a simple blanking and piercing die, progressive die, drawing die etc. Any one of these exercises should be given as an assignment. A group of students (maximum number in a group should be 4) should submit assembly drawing and part drawings, completely dimensioned, indicating the necessary manufacturing tolerances, surface finish symbols and geometric tolerances wherever necessary. Tool design project must be completed using appropriate solid modeling software. Computer generated drawings must be submitted. Design calculations must be hand written and should be included in the report. Tool design project should be given due credit in internal assessment.

Course Outcomes: At the end of the course, the student will be able to:
CO1: Select appropriate cutting tools required for producing a component.
CO2: Understand and interpret cutting tool and tool holder designation systems.
CO3: Select suitable locating and clamping devices for a given component for various operations.
CO4: Analyze and design a jig/fixture for a given simple component.
CO5: Understand various press tools and press tool operations.
CO6: Classify and explain various die casting and injection moulding dies.

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Tool Design	Cyril Donaldson, George H. Lecain, V.C.Goold,	Mc Graw Hill Education	5th edition, 2017
2	Manufacturing technology	P.N.Rao,	Mc Graw Hill Education	4th edition, 2013
Reference Books				
1	Jigs and Fixtures	P.H.Joshi	Mc Graw Hill Education	3rd edition, 2010
2	Fundamentals of Tool Design	John.G. Nee, William Dufraine, John W. Evans, Mark Hill	Society of Manufacturing Engineers	2010
3	Fundamentals of Tool Design	Frank W.Wilson	PHI publications	
4	An introduction to Jig and Tool design	Kempester M.H.A	VIVA Books Pvt.Ltd.	2004
5	Metal cutting and Tool Design	RanganathB.J	Vikas publishing house	

6	Metal cutting theory and practice	V. Arshinov& G. Alekseev	MIR publishers, Moscow	
7	Design and production of metal cutting tools	Rodin	Beekman publishers	
8	Production Technology	HMT	TataMc Graw Hill	2013.

B. E. MECHANICAL ENGINEERING **Choice Based Credit System (CBCS) and Outcome Based Education (OBE)** **SEMESTER - VIII** **Professional Elective-4**			
FRACTURE MECHANICS			
Course Code	**18ME826**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To expose the students to the fundamentals of mechanics of fracture of materials.
- The students will learn about stress / strain and deformation fields near a crack tip, fracture characterizing parameters like stress intensity factor and J integral and kinetics of fatigue crack growth.
- To expose the students to fundamentals of linear elastic fracture mechanics, nonlinear (Elastic-Plastic) fracture mechanics and fatigue crack growth.
- Exposure to experimental methods for determining the fracture toughness (for example, ASTM standard procedure for JIC testing).
- To learn the mechanism of failure of structures by fatigue crack growth.

Module-1

Fracture mechanics principles: Introduction and historical review, Sources of micro and macro cracks. Stress concentration due to elliptical hole, Strength ideal materials, and Griffith's energy balance approach. Fracture mechanics approach to design, NDT and Various NDT methods used in fracture mechanics, Numerical problems. The Airy stress function. Effect of finite crack size. Elliptical cracks, Numerical problems.

Module-2

Plasticity effects: Theory of Plastic deformation, Irwin plastic zone correction. Dugdale's approach. The shape of the plastic zone for plane stress and plane strain cases. The plate thickness effect, numerical problems. Determination of Stress intensity factors and plane strain fracture toughness: Introduction, estimation of stress intensity factors. Experimental method- Plane strain fracture toughness test, The Standard test, size requirements, etc.

Module-3

The energy release rate, Criteria for crack growth. The crack resistance(R curve). Compliance. Tearing modulus. Stability.

Elastic plastic fracture mechanics: Fracture beyond general yield. The Crack-tip opening displacement. The Use of CTOD criteria. Experimental determination of CTOD. Parameters affecting the critical CTOD.

Module-4

J integral: Use of J integral. Limitation of J integral. Experimental determination of J integral and the parameters affecting J integral.

Dynamics and crack arrest: Crack speed and kinetic energy. Dynamic stress intensity and elastic energy release rate. Crack branching. Principles of crack arrest. Crack arrest in practice. Dynamic fracture toughness.

Module-5

Fatigue crack propagation and applications of fracture mechanics: Crack growth and the stress intensity factor. Factors affecting crack propagation. Variable amplitude service loading, Means to provide fail-safety, Paris law, Required information for fracture mechanics approach.

Course Outcomes: At the end of the course the student will be able to:

CO1: Analyse the effects of crack like defects on the performance of Aerospace, Civil, and Mechanical Engineering structures.

CO2: Apply the concepts of fracture mechanics to select appropriate materials for engineering structures to insure damage tolerance.

CO3: Understand mechanics of crack tip fields and appropriate fracture characterizing parameters like stress intensity factor and J integral or nonlinear energy release rate and how to compute them using various methods.

CO4: Apply the concepts of fracture mechanics to determine critical crack sizes and fatigue crack propagation rates in engineering structures leading to life estimation.

CO5: Understand the status of academic research in field of fracture mechanics.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Elements of fracture mechanics	Prasanth Kumar	Wheeter publication	1999
2	Fracture Mechanics: Fundamentals and Applications	Anderson	CRC press	3rd Ed., 2005
Reference Books				
1	Introduction to fracture mechanics	Karen Hellan	McGraw Hill	2nd Edition
2	Engineering fracture mechanics	S.A. Meguid	Elsevier Applied Science	1989
3	Fracture of Engineering Brittle Materials	Jayatilaka	Applied Science Publishers	1979
4	Fracture and Fatigue Control in Structures	Rolfe and Barsom	Prentice Hall	1977
5	Engineering Fracture Mechanics	Broek	MartinusNijhoff publishers	1982
6	Advanced Fracture Mechanics	M.F.Kanninen and C.H.Popelar	Oxford press	1985