

### CO'S OF 3<sup>RD</sup> SEM SUBJECTS

#### TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES (18MAT31)

- 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 behavior 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, signal and systems.
- CO4: Solve 1<sup>st</sup> and 2<sup>nd</sup> order ordinary differential equations arising in engineering problems using in single step and multi step numerical methods.
- CO 5: determine the externals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.

#### ELECTRIC CIRCUIT ANALYSIS (18EE32)

- CO1: Analyze DC & AC Networks by applying basic laws and transformation techniques.
- CO2: Evaluate complexity of network using various transformation techniques and network theorems.
- CO3: Solve numerical examples on series, parallel resonance and initial conditions.
- CO4: Synthesize typical wave forms using Laplace transformation
- CO 5: Evaluate the performance of two port network and unbalanced three phase system.

#### TRANSFORMER AND GENERATORS (18EE33)

- CO1: Determine the efficiency, voltage regulation and equivalent circuit constants of a 1-phase transformer from O.C and S.C test.
- CO2: Compare the types of 3-phase transformer connections (bank) with respect to advantages, disadvantages and applications.
- CO3: Analyze the performance characteristics of D.C. generator and synchronous generators.
- CO4: Determine the voltage regulation of a synchronous generator by EMF, MMF and ZPF methods.
- CO5: Discuss the parallel operation of 1-phase transformer and synchronous generator.

#### ANALOG ELECTRONIC CIRCUITS (18EE34)

- CO1: Examine the output response of clipper and clamper circuits
- CO2: Analyze different transistor biasing circuits and transistor at low frequency
- CO3: Derive the input and output impedances of feedback and general amplifiers
- CO4: Evaluate the efficiency of power amplifiers and compare various oscillators
- CO5: Analyze FET and MOSFET amplifiers in the common source mode with fixed bias configuration

#### DIGITAL SYSTEM DESIGN (18EE35)

- CO1: Discuss combinational circuits.
- CO2: Implement adder, subtractor, decoder, encoders, binary comparators, multiplexers, demultiplexers and code converter.
- CO3: Design sequential circuits
- CO4: Analyze Moore and Mealy models and State machine notations.
- CO5: Explain the functioning of Read only and Read/Write Memories, Programmable ROM, EPROM and Flash memory.

#### ELECTRICAL & ELECTRONIC MEASUREMENT (15EE36)

- CO1: Determine the values of Resistance, Inductance, Capacitance and magnetic circuit parameters.
- CO2: Deduce the Expressions for various parameters such as torque, power, power factor of 3-phase circuits.
- CO3: Analyse the methods of extension of Instrument ranges .
- CO4: Compare Electronic and Digital Instruments.
- CO5: Distinguish display devices and Recording devices.

<b>ELECTRICAL MACHINES LAB-1(18EEL37)</b>
CO1: Pre-determine efficiency, voltage regulation and equivalent circuit constants of a 1-phase transformer by conducting O.C and S.C tests.
CO2: Perform parallel operation of two different kVA transformers to determine the load shared by each transformer.
CO3: Conduct experiments on 3-phase transformer connections (Bank) to determine the efficiency.
CO4: Pre-determine voltage regulation of a 3-phase synchronous generator by EMF and MMF methods by Conducting O.C and S.C tests.
CO5: Analyze the performance of synchronous generator by connecting it to the infinite bus bar.

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<b>ELECTRONICS LABORATORY(18EEL38)</b>
CO1:Test rectifier circuits with and without filter.
CO2: Analyse BJT amplifier and oscillators.
CO3: Realize Boolean expressions, adders and subtractors using basic gates.
CO4: Design BCD to excess 3 code converter, binary to gray code converter.
CO5: Design counters and sequence generators.

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<b>CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND CYBER LAW (CPC) (18CPC39)</b>
CO 1: Have constitutional knowledge and legal literacy.
CO 2: Understand Engineering and Professional ethics and responsibilities of Engineers.
CO 3: Understand the the cybercrimes and cyber laws for cyber safety measures.

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**CO'S OF 4th SEM SUBJECTS**

<b>COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS (18MAT41)</b>
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.

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<b>ELECTRICAL POWER GENERATION (18EE42)</b>
CO 1:Analyse block diagram pertaining to different power plants
CO 2:Identify the equipments employed in power plants & sub-stations
CO 3:Adopt suitable grounding methods of electrical equipment in power system.
CO 4:Analyse the economic aspects of power generation
CO 5:Select suitable methods for improving the power factor.

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<b>TRANSMISSION AND DISTRIBUTION (18EE43)</b>
CO-1:Calculate sag at different levels of support and deduce expressions for advantages of high voltage transmission.
CO-2:Compare Insulator types, methods of increasing string efficiency,GMR & GMD.
CO-3:Estimate the values of inductance and capacitance with equilateral & unsymmetrical spacing, ABCD constants.
CO-4:Categorize the transmission lines and Underground cables.
CO-5:Analyse AC distribution systems, advantages & Disadvantages of Corona, methods of reducing corona.

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<b>ELECTRIC MOTORS (18EE44)</b>
CO-1:Determine the losses and efficiency of DC machines by direct and indirect tests.
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CO-3:Discuss the speed control methods of DC and AC motors.
CO-4:Compare construction, operation, characteristics and applications of single phase induction motors and special motors.
CO-5:Analyse the performance characteristics of synchronous motor.

<b>ELECTROMAGNETIC FIELD THEORY (18EE45)</b>
CO-1:Solve problems on electric force, electric field intensity due to point, linear, volume charges by applying Coulomb's law and Gauss's law.
CO-2:Determine energy and potential for various charge distributions and apply continuity equation of current to calculate flow of current, total charge, charge density for conductors.
CO-3:Apply Poisson's and Laplace's equation for solving boundary value problems associated with electrostatics and magneto-statics.
CO-4:Analyze the applications of magneto-statics by applying Biot-savart's law, Ampere's circuital law and derive the concepts of magnetic forces and materials to characterize the magnetic circuits.
CO-5: Analyze Maxwell's equations for static fields, time varying fields, EM waves in free space, conductors and evaluate power associated with EM waves using Poynting theorem.

<b>OPERATIONAL AMPLIFIERS AND LINEAR INTEGRATED CIRCUITS (18EE46)</b>
CO-1:Analyze the operations of Op-Amp, Regulator, Timer and PLL.
CO-2:Design linear circuits using Linear IC's.
CO-3:Construct Comparators, Converters signal processing circuits, filters and voltage regulators.
CO-4:Analyze the performance factors of PLL and generators
CO-5:Demonstrate the applications of 555 Timer and Converters.

<b>ELECTRICAL MACHINE LAB-2 (18EEL47)</b>
CO-1: Conduct an experiment to control the speed of DC Shunt motor by armature and field control methods.
CO-2: Pre-determine the losses and efficiency of DC machines by conducting direct and indirect loading tests.
CO-3: Assess performance characteristics of DC shunt motor, 1- $\emptyset$ induction motor and 3- $\emptyset$ induction motor by performing load test .
CO-4: Analyze the performance characteristics of 1- $\emptyset$ and 3- $\emptyset$ induction motors by Conducting No-load and Blocked rotor tests.
CO-5: Perform experiment on synchronous motor to draw V-curves and Inverted V-curves for different loads.

<b>OP- AMP AND LINEAR ICS LABORATORY (18EEL48)</b>
CO-1: Design precision full wave rectifier and RC phase shift oscillator.
CO-2:Analyze inverting & non inverting amplifiers using op-amp
CO-3:Demonstrate the operation of Schmitt trigger, comparator, ZCD, adder, subtractor, integrator, differentiator circuits using
CO-4:Examine the operation of R-2R ladder DAC& 2-bit Flash ADC
CO-5:Analyze IC555timer based pulse generator for specified pulse and voltage regulator using 78 and79 series ICs.

### CO'S OF 5<sup>th</sup> SEM SUBJECTS

<b>MANAGEMENT &amp; ENTREPRENEURSHIP (18EE51)</b>
CO-1:Compare management & administration with the principles and approaches , focusing on the managerial tasks and process.

CO-2: Analyze about the work allocation in the organization, the modes of communication and importance of managerial coordination & control in business.
CO-3: Evaluate the social consideration for effective use in business applications.
CO-4: Distinguish the concepts of entrepreneurship and the role and importance of the entrepreneur in economic development.
CO-5: Communicate the concepts of project management, capital building process, project feasibility study, project appraisal and project financing.

#### MICROCONTROLLER(18EE52)

CO-1:Differentiate between Microprocessor and Microcontroller.
CO-2:Illustrate the internal organization of microcontroller and memory organization.
CO-3:Demonstrate programming proficiency using various addressing modes and instructions of microcontroller.
CO-4:Develop assembly and embedded C programs in 8051 microcontroller.
CO-5:Demonstrate the interfacing of microcontroller with external peripheral devices.

#### POWER ELECTRONICS (18EE53)

CO-1:Analyse performance of diode rectifiers with R & RL loads.
CO-2:Compare the performance of various power semiconductor devices.
CO-3:Analyse various turn on, turn -off and protection methods of thyristors.
CO-4:Design various single phase & three phase power converters.
CO-5:Evaluate the performance of chopper and inverter circuits.

#### SIGNALS AND SYSTEMS (18EE54)

CO-1:Analyze different types of signals and perform various operations on signals
CO-2: Analyze various system properties
CO-3:Determine the response of systems using convolution sum , convolution integral, and block diagram representation of a linear time invariant system
CO-4:Solve differential equations and difference equations of system to determine response
CO-5:Apply the continuous time Fourier transform, discrete time Fourier transform, z-Transform, to the analysis of LTI continuous and discrete-time systems.

#### ELECTRICAL MACHINE DESIGN (18EE55)

CO-1:Classify the materials used in electrical machines with their design limitations.
CO-2:Estimate the number of cooling tubes, no load current and leakage reactance of core type transformer.
CO-3:Develop the output equations of transformer, DC machines and AC machines.
CO-4:Design the field windings, stator and rotor circuits of a DC and AC machines.
CO-5:Analyze the effect of short circuit ratio on performance of synchronous machines.

#### HIGH VOLTAGE ENGINEERING (18EE56)

CO-1:illustrate conduction & breakdown in gases,liquid and solid dielectrics
CO-2:analyze the generation of high voltages,currents and impulse voltages
CO-3:measure of impulse voltages,currents and high voltages
CO-4:analyze the causes for over voltages and switching surges
CO-5:compare effective techniques for non destructive testing of materials and electrical apparatus

MICROCONTROLLER LAB (18EEL57)
CO-1:Implement the programming skills for data transfer, arithmetic, boolean and logical operations.
CO-2:Develop ALP for code conversion programs.
CO-3:Demonstrate ALP using subroutines for generation of delays, counters, configuration of SFRs for serial communication
CO-4:Illustrate interfacing of stepper motor and Dc motor for controlling the speed.
CO-5:Simulate different waveforms using DAC interface.

POWER ELECTRONICS LAB (18EEL58)
CO-1:Perform experiment to sketch the static characteristics of semi conductor devices
CO-2:Analyze Triggering of the SCR by different methods.
CO-3: Assess the performance of single phase controlled full wave rectifier and AC voltage rectifier with R and RL loads.
CO-4: conduct experiment to control speed of DC motor, universal motor and stepper motor.
CO-5: Analyze the performance of single phase full bridge inverter connected to R load.

ENVIRONMENTAL STUDIES (18CIV59)
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.

### CO'S OF 6<sup>th</sup> SEM SUBJECTS

CONTROL SYSTEMS (18EE61)
CO-1:Develop the differential equations for given mechanical and electrical systems
CO-2:Apply block diagram manipulation and signal flow graph methods to obtain transfer function of systems
CO-3:Evaluate the stability of LTI systems using RH criterion, root locus, Bode Plot and Nyquist plot
CO-4:Investigate the performance of a given system in time and frequency domain
CO-5:Compare the different compensator configurations and controller configurations

POWER SYSTEM ANALYSIS – 1 (18EE62)
CO-1:Apply the concept of single line diagram and P.U system
CO-2:Evaluate short circuit analysis for symmetrical and unsymmetrical components in power system
CO-3:Apply the concept of sequence impedance and sequence network in power system
CO-4:Analyze 3- phase synchronous machine for different unsymmetrical faults using symmetrical component
CO-5:Analyze dynamics of synchronous machine, stability and EAC for different fault conditions

DIGITAL SIGNAL PROCESSING (18EE63)
CO-1:Compute DFT and IDFT of discrete time sequences using properties of DFT
CO-2:Evaluate DFTs using convolution methods
CO-3:Develop FFT algorithms for computing the DFT of Discrete time sequence.
CO-4:Design IIR and FIR filters
CO-5:Realize IIR and FIR digital filters in different structures

COMPUTER AIDED ELECTRICAL DRAWING (18EE643)
CO-1:To draw the DC and AC armature winding diagrams for given number of poles and slots or conductors.
CO-2:To draw single line diagrams of power stations from the station layout data.
CO-3:To draw sectional views of assembled transformer from design data.
CO-4:To draw sectional views of DC machine and its parts from design data.
CO-5:To draw sectional views of alternator and its parts from design data.

CONTROL SYSTEM LABORATORY (1EEL66)
CO-1:Evaluate time domain specifications of a typical second order system
CO-2:Analyse lead, lag and lead lag compensating networks
CO-3:Compare different types of controllers.
CO-4: Sketch the characteristics of AC,DC servomotors and synchro transmitter and receiver pairs
CO-5:Investigate the stability of given TF using Nyquist,Bode and Root locus plots.

DIGITAL SIGNAL PROCESSING LAB (1EEL67)
CO-1:Evaluate the impulse response of a system.
CO-2:Perform convolution of given sequence to evaluate the response of a system.
CO-3:Compute DFT and IDFT of a given sequence using the basic definition and fast method
CO-4:Provide a solution for a given difference equation.
CO-5:Design and implement IIR and FIR filters.

### CO'S OF 7<sup>th</sup> SEM SUBJECTS

POWER SYSTEM ANALYSIS-2 (17EE71)
CO-1: Formulate network matrices and models for solving load flow problems.
CO-2:Perform steady state power flow analysis of power systems and solution of swing equation for multi-machine stability by using numerical iterative techniques.
CO-3:Adopt a method to control voltage profile and for optimal unit commitment.
CO-4: Discuss optimal scheduling for thermal system, hydro-thermal system, power system security and reliability.
CO-5:Analyze short circuit faults in power system networks using bus impedance matrix.

POWER SYSTEM PROTECTION (17EE72)
CO-1 Compare the performance of various relays.
CO-2:Distinguish between over current protection and distance protection
CO-3 Analyze different protection schemes of generator and transformer
CO-4: Categorize different types of circuit breakers and fuses
CO-5:Analyze protection against over voltages and Gas Insulated Substation

HVE (17EE73)
CO-1:illustrate conduction & breakdown in gases, liquid and solid dielectrics
CO-2:analyze the generation of high voltages, currents and impulse voltages
CO-3:measure of impulse voltages, currents and high voltages
CO-4:analyze the causes for over voltages and switching surges
CO-5:compare effective techniques for non destructive testing of materials and electrical apparatus

UTILIZATION OF ELECTRICAL POWER (17EE742)
CO1: Illustrate methods and applications of electric heating for industry.
CO2: Design illumination system for various applications.
CO3: Analyse mechanics of train movement and performance characteristics of traction motors
CO4: Discuss electric braking and electrification of traction system
CO5: Analyze the configuration of electric and hybrid-electric vehicles.

T & C ( 17EE752)
CO1: Identify the tools and equipments used for installation and maintenance of various electrical equipments.
CO2: Describe the process of plan, installation and commissioning of various electrical equipments.
CO3: Differentiate the performance specifications of various electrical equipments.
CO4: Explain the routine, type and special tests for various electrical equipments.
CO5: Illustrate the operation of an various electrical equipments and switchgears.

PSS LAB(17EEL76)
CO-1:Develop a program in MATLAB to evaluate the performance of short, medium and long transmission lines.
CO-2:Develop a program in MATLAB to evaluate the transient stability of a single machine connected to infinite bus bar under three phase fault in a radial power system by using swing equation.
CO-3:Develop programs in MATLAB to formulate bus admittance and bus impedance matrices of interconnected power systems.
CO-4:Use Mi-Power software package to solve power flow problem for simple power systems and to study symmetrical and unsymmetrical faults in radial power systems.
CO-5:Use Mi-Power software package to study optimal generation scheduling problems for thermal power plants and the power angle characteristics of salient and non-salient pole alternator.

RELAY & HIGH VOLTAGE LAB(17EEL77)
CO-1:Demonstrate the operation of microprocessor based and Electro mechanical type relays at fault conditions such as over current, over voltage and under voltage and plot their characteristics at different T.S.M's and P.S.M's
CO-2:Demonstrate operation of negative sequence relay, bias characteristics of differential relay.
CO-3:Demonstrate feeder and motor protection scheme and fault studies.
CO-4:Determine breakdown strength of gaseous and liquid insulators for HVAC and HVDC.
CO-5:Perform field mapping using electrolytic tank

PROJECT PHASE-I (17EEP78)
CO1:Identify real world electrical engineering problems through survey and review of literature.
CO2: Apply fundamental knowledge of mathematics, science and engineering principles in designing the system components with consideration of environmental factors, economy, safety and societal needs
CO3: Identify a suitable engineering technology /software tool/data interpretation for carrying out projects.
CO4: Demonstrate the knowledge, skills and attitude of professional engineers.
CO5: communicate effectively and develop technical report s ethically.

## CO'S OF 8<sup>th</sup> SEM SUBJECTS

### POWER SYSTEM OPERATION AND CONTROL(17EE81)

- CO-1: Highlight the importance of SCADA and Unit Commitment in power system.
- CO-2: Discuss the issues of hydrothermal scheduling and solutions to hydro thermal problems
- CO-3: Model the AVR and ALFC loop for single area, multi-control area and interconnected system
- CO-4: Analyze the need of reactive power and voltage stability in power system.
- CO-5: Distinguish the different methods of state estimation and power system reliability.

### IDA(17EE82)

- CO-1: Analyze the dynamics and operational modes of electrical drives
- CO-2: Determine the ratings of the motors based on duty cycle and thermal model of heating and cooling
- CO-3: Compare the performance of DC motor drives fed by different converters
- CO-4: Analyze the performance of AC motor drives under different operating conditions and Techniques
- CO-5: Select the electric drives based on the industrial applications

### INTEGRATION OF DISTRIBUTED GENERATION (17EE833)

- CO1: Review the different reasons for new type of power production in the power system
- CO2: Analyze the effects of integration of distributed generation on the performance the system.
- CO3: Examine increased risk of overloading and losses of DG integration
- CO4: Analyze impact of distributed generation on voltage magnitude variation
- CO5: Analyze various power quality disturbances developed due to DG integration.

### INTERNSHIP (17EE84)

- CO-1: Apply knowledge of the industry & skills learnt to classroom work.
- CO-2: Acquire practical experience in industry
- CO-3: Recognize the areas for career and skill development
- CO-4: Develop the skills to enable lifelong learning
- CO-5: Develop oral communication skills and develop technical reports ethically

### PROJECT PHASE –II (17EEP85)

- CO-1: Formulate real world electrical engineering problems through survey and review of literature.
- CO-2: Develop project with consideration of environmental factors, economy, safety and societal needs.
- CO-3: Apply appropriate technology/modern tools
- CO-4: Demonstrate the leadership skills and ability to work individually as well as in team
- CO-5: Develop oral Communication skills and write the project report ethically

### TECHNICAL SEMINAR (17EES86)

- CO-1: Identify topic of current, real-time issues in the field of electrical engineering. Through survey and review of literature
- CO-2: Attain the knowledge of topic selected through independent and collaborative learning.
- CO-3: Explore concepts in social and academic contexts .
- CO-4: Apply principles of ethics and respect in interaction with others
- CO-5: Communicate effectively to audience and develop technical reports ethically