R23-REGULATION

Course Outcomes (COs)

B.Tech. II Year

II Year I Sem			
Course Code	**Course Name**	**Course Outcome No**	**Course Outcome-Statement**
MA301BS	**Numerical Methods and Complex variables**	C201.1	Understand and apply Fourier series and Fourier transforms to engineering problems.
		C201.2	Solve algebraic and transcendental equations and perform interpolation using numerical methods.
		C201.3	Apply numerical methods for integration and solving ordinary differential equations.
		C201.4	Analyze complex functions and apply conformal mappings and Mobius transformations.
		C201.5	Evaluate complex integrals using Cauchy's theorems and residue calculus.
EE302PC	**Electrical Machines-I**	C202.1	Explain the construction, working principle, and characteristics of DC generators.
		C202.2	Analyze the operation, speed control methods, and efficiency of DC motors.
		C202.3	Apply testing methods like brake test, Swinburne's, and Hopkinson's to assess DC machine performance.
		C202.4	Understand the construction, operation, phasor diagram, and efficiency analysis of single-phase transformers.
		C202.5	Analyze transformer testing, parallel operation, and poly-phase transformer connections and applications.
EE303PC	**Power System-I**	C203.1	Describe the working principles of conventional and non-conventional power generation systems.
		C203.2	Analyze load curves, power factor, tariffs, and evaluate the cost of electrical energy generation.
		C203.3	Calculate inductance and capacitance of overhead transmission lines and analyze insulator performance.
		C203.4	Differentiate between AIS and GIS substations and explain their layout and equipment.

		C203.5	Perform voltage drop calculations for DC and AC distribution systems under various load conditions.
EE304PC	**Analog Electronic Circuits**	C204.1	Analyze diode and BJT circuits including rectifiers, clippers, clampers, and amplifiers using small signal models.
		C204.2	Examine and design FET and MOSFET based amplifier circuits including their small signal parameters.
		C204.3	Interpret the operation of multistage, differential, and power amplifiers (Class A, B, and C).
		C204.4	Explain feedback amplifier types and oscillator circuits, and analyze their operation and design conditions.
		C204.5	Apply the characteristics of operational amplifiers in linear waveform generation and signal processing.
EE305PC	**Electro Magnetic Fields**	C205.1	Analyze electric fields, potential, and energy using vector calculus and Gauss's Law.
		C205.2	Examine the behavior of conductors and dielectrics, and solve problems using Laplace and Poisson equations.
		C205.3	Apply laws of magnetostatics to compute magnetic fields and forces in current-carrying conductors.
		C205.4	Derive and apply Maxwell's equations to time-varying electromagnetic fields.
		C205.5	Analyze electromagnetic wave propagation in various media and apply Poynting theorem.
EE306PC	**Electrical Machines Laboratory-I**	C206.1	Analyze magnetization and load characteristics of DC generators and motors.
		C206.2	Determine efficiency and performance parameters of DC machines using various testing methods.
		C206.3	Conduct and analyze open-circuit (OC) and short-circuit (SC) tests on transformers and interpret results.
		C206.4	Verify and understand the relationship between voltages and currents in three-phase transformer connections.
		C206.5	Perform additional tests to evaluate machine performance.
EE307PC	**Analog Electronic Circuits Laboratory**	C207.1	Analyze and characterize semiconductor devices like PN junction diodes and BJTs.
		C207.2	Study and evaluate rectifier circuits for ripple factor, regulation, and efficiency.
		C207.3	Analyze FET characteristics and calculate

			parameters like transconductance and output resistance.
		C207.4	Design and analyze operational amplifier circuits including inverting, non-inverting, integrator, and differentiator circuits.
		C207.5	Design and test oscillators and power amplifiers, analyzing their waveforms and efficiency.
EE308PC	**Electrical Simulation tools Laboratory**	C208.1	Understand and apply basic simulation platform tools and matrix operations.
		C208.2	Model and solve linear and nonlinear differential equations using simulation tools.
		C208.3	Simulate and verify electrical circuits and network theorems with dependent and independent sources.
		C208.4	Analyze and simulate electronic devices, filters, motors, and transformers using simulation platforms.
		C208.5	Model and simulate renewable energy systems and power electronic circuits effectively.
***MC309**	**Gender Sensitization Laboratory**	C209.1	Understand and explain fundamental gender concepts and terminology.
		C209.2	Analyze gender roles, relations, and their social impacts.
		C209.3	Examine the role of gender in labor, development, and governance.
		C209.4	Recognize different forms of gender-based violence and its social implications.
		C209.5	Explore gender representation in culture, media, and literature.

II Year II Sem.			
EE401PC	**Solid Mechanics & Hydraulic Machines**	C210.1	Understand and apply concepts of forces, moments, friction, and equilibrium in engineering systems.
		C210.2	Calculate centroid, center of gravity, and analyze stresses and strains in materials.
		C210.3	Analyze kinematics and kinetics of particles and rigid bodies, including energy and momentum principles.
		C210.4	Understand the principles and operation of hydraulic machinery including jets and hydrodynamic forces.
		C210.5	Explain the working, classification, and performance of turbines and pumps in hydraulic systems.

EE402PC	**Measurements and Instrumentation**	C211.1	Understand the principles, classifications, and working of basic electrical measuring instruments.
		C211.2	Apply potentiometers and instrument transformers for accurate measurement of electrical quantities.
		C211.3	Analyze power and energy measurement techniques in single-phase and three-phase systems.
		C211.4	Understand the operation and applications of various DC and AC bridge circuits for precise measurements.
		C211.5	Identify and apply different transducers and digital/smart metering devices for electrical measurements.
EE403PC	**Electrical Machines–II**	C212.1	Understand the construction, working principle, and key performance parameters of poly-phase induction machines.
		C212.2	Analyze the characteristics, starting methods, and speed control techniques of induction machines.
		C212.3	Understand the construction, winding types, and performance parameters of synchronous machines.
		C212.4	Explain the principles and applications of parallel operation of synchronous machines and synchronous motors.
		C212.5	Understand the construction, operation, and applications of various single-phase machines.
EE404PC	**Digital Electronics**	C213.1	Understand the fundamentals of digital signals, Boolean algebra, and number systems including complements arithmetic.
		C213.2	Analyze and design combinational circuits using Karnaugh maps, multiplexers, and demultiplexers.
		C213.3	Design arithmetic and logic circuits such as adders, subtractors, comparators, encoders, and decoders.
		C213.4	Understand and implement sequential circuits including flip-flops, counters, and shift registers.
		C213.5	Explain semiconductor memories and programmable logic devices like ROM, RAM, PLA, PAL, and FPGA.
EE405PC	**Power System-II**	C214.1	Analyze the performance of transmission lines and determine parameters like ABCD constants and the Ferranti effect.
		C214.2	Understand the concept of corona discharge, its causes, losses, and mitigation techniques.

		C214.3	Explain and evaluate methods of voltage control, power factor improvement, and compensation in power systems.
		C214.4	Apply per unit systems in power system analysis and analyze traveling wave phenomena on transmission lines.
		C214.5	Understand protection mechanisms for overvoltage's and apply insulation coordination techniques.
EE406PC	**Digital Electronics Laboratory**	C215.1	Implement and verify basic logic gates and Boolean expressions using universal gates.
		C215.2	Design combinational circuits like adders, subtractors, code converters, and comparators.
		C215.3	Construct sequential circuits such as shift registers and sequence generators.
		C215.4	Design and realize synchronous and asynchronous counters using flip-flops.
		C215.5	Apply knowledge of multiplexers for logical function implementation and data selection.
EE407PC	**Measurements and Instrumentation Laboratory**	C216.1	Calibrate and test various energy meters and measuring instruments like PMMC, LPF wattmeter, and power factor meters.
		C216.2	Analyze and measure resistance using precision bridges like Kelvin's, Schering, and Anderson's bridges.
		C216.3	Perform testing of instrument transformers (CTs and PTs) for ratio error and phase angle using comparison and null methods.
		C216.4	Measure electrical parameters using potentiometers and single-phase wattmeters in various configurations.
		C216.5	Demonstrate practical knowledge of transducers and sensors such as LVDTs and strain gauges.
EE408PC	**Electrical Machines Laboratory-II**	C217.1	Conduct tests on transformers to evaluate efficiency, voltage regulation, and heat run behavior.
		C217.2	Perform tests on three-phase induction motors to determine performance characteristics and equivalent circuits.
		C217.3	Analyze and determine the voltage regulation of alternators using various methods (Synchronous Impedance, MMF, ZPF, ASA).
		C217.4	Evaluate the operational characteristics of synchronous motors including V and inverted V curves.
		C217.5	Measure salient-pole alternator parameters (Xd and Xq), sequence impedances, and conduct

			parallel operation and vector grouping of transformers.
EE409PC	**Real-time Research Project/ Field Based Project**	C218	
***MC410**	**Constitution of India**	C219.1	Understand the historical background and philosophy behind the Indian Constitution.
		C219.2	Explain the fundamental rights, duties, and directive principles enshrined in the Constitution.
		C219.3	Describe the structure, powers, and functions of the organs of governance: Legislature, Executive, and Judiciary.
		C219.4	Analyze the role and importance of local administration and grassroots democracy in India.
		C219.5	Comprehend the functions and significance of the Election Commission and institutions for social welfare.

PAC Coordinator **HoD**

JOGINPALLY B.R. ENGINEERING COLLEGE

Department of Electrical and Electronics Engineering

III Year B.Tech. EEE

III Year I-Sem			
EE501PE	**Power Electronics**	C301.1	Understand the characteristics and operation of power semiconductor devices and gate drive circuits.
		C301.2	Analyze the operation of single-phase and three-phase phase-controlled rectifiers for various types of loads.
		C301.3	Evaluate the performance of basic DC-DC converters (buck, boost, buck-boost) under steady-state conditions.
		C301.4	Analyze the operation and control strategies of single-phase and three-phase inverters using PWM techniques.
		C301.5	Understand the principles and practical applications of AC voltage regulators and cycloconverters.
EE502PE	**Control Systems**	C302.1	Develop mathematical models for electrical and mechanical systems and represent them using transfer functions and block diagrams.
		C302.2	Analyze the time-domain response of control systems and determine system stability using classical methods like Routh-Hurwitz and Root Locus.
		C302.3	Evaluate system performance in the frequency domain using Bode, Polar, and Nyquist plots.
		C302.4	Design controllers and compensators to meet specified performance requirements using classical methods.
		C302.5	Apply state space modeling for dynamic systems, and design state feedback controllers using pole placement.
EE503PE	**Microprocessors & Microcontrollers**	C303.1	Understand the architecture, programming model, memory organization, and instruction set of 8086 microprocessor.
		C303.2	Interface various peripheral devices like 8255, 8257, and 8259 with 8086 and design related applications.

		C303.3	Describe serial communication standards and interface USART with microprocessor systems.
		C303.4	Understand the architecture, instruction set, and programming of 8051 microcontroller including interrupts and timers.
		C303.5	Design microcontroller-based systems for real-time applications involving ADC, DAC, stepper motors, and displays.
EE511PE	**IOT APPLICATIONS IN ELECTRICAL ENGINEERING (Professional Elective-I.1)**	C304.1	Understand the working principles, classification, and applications of various temperature, pressure, humidity, and force sensors.
		C304.2	Explain the operating principles of occupancy, motion, position, velocity, and flow sensors used in intelligent systems.
		C304.3	Analyze the basic design and working of MEMS-based sensors and actuators, including fabrication and application.
		C304.4	Evaluate the role of IoT at different levels of the smart grid and its applications in metering, monitoring, and smart homes.
		C304.5	Understand the concept, architecture, and challenges of the Internet of Energy and its relevance to future smart energy systems.
EE512PE	**HIGH VOLTAGE ENGINEERING (PE-1)**	C305.1	Understand the mechanisms of breakdown in gases, liquids, and solid insulating materials.
		C305.2	Explain the principles and methods of generation of high DC, AC, impulse voltages, and currents.
		C305.3	Apply measurement techniques for high voltages and currents, including dielectric properties.
		C305.4	Analyze the causes and effects of lightning and switching overvoltages and methods of protection.
		C305.5	Understand high voltage testing procedures, standards, and safety requirements in high voltage labs.
EE513PE	**COMPUTER AIDED ELECTRICAL MACHINE DESIGN (Professional Elective-I.3)**	C306.1	Understand the fundamental considerations in electrical machine design, including material selection, thermal management, and rating principles.
		C306.2	Apply the design principles for transformers, including sizing, core and winding design, and cooling system development.
		C306.3	Design induction motors by selecting appropriate dimensions, rotor and stator

			configurations, and evaluating performance characteristics.
		C306.4	Analyze and design synchronous machines, including salient pole and turbo alternators, with attention to field and damper windings.
		C306.5	Understand the need for Computer Aided Design (CAD) in modern electrical machines, and gain a basic introduction to FEM and design of PMSMs, BLDCs, SRMs, and claw-pole machines.
SM504MS	**Business Economics and Financial Analysis**	C307.1	Understand the fundamentals of business structures, economic concepts, and the role of business economics.
		C307.2	Analyze demand and supply, including elasticity and demand forecasting techniques for decision making.
		C307.3	Explain production functions, cost analysis, market structures, and pricing methods in business.
		C307.4	Apply basic accounting principles, prepare financial statements, and understand double-entry bookkeeping.
		C307.5	Interpret financial ratios for analyzing business liquidity, profitability, and solvency.
EE505PC	**Microprocessors & Microcontrollers Laboratory**	C308.1	Develop and debug assembly language programs using 8086 microprocessor addressing modes.
		C308.2	Implement and test interfacing of ADC, DAC, stepper motor, and communication protocols with 8086.
		C308.3	Write and verify programs for timer, interrupt handling, and UART communication on 8051.
		C308.4	Interface and control peripherals like LCD and matrix keyboard with 8051 microcontrollers.
		C308.5	Utilize DMA controller for efficient data transfer between peripherals and memory.
EE506PC	**Power Electronics Laboratory**	C309.1	Analyze the characteristics and operation of power semiconductor devices like SCR, MOSFET, and IGBT.
		C309.2	Design and implement gate firing and forced commutation circuits for SCR-based converters.
		C309.3	Construct and test AC voltage controllers and converters including cyclo-converters and inverters with various loads.
		C309.4	Simulate and interpret waveforms of different power electronic converters and controllers under various operating conditions.

		C309.5	Apply PWM techniques for controlling inverter output voltage and study performance of power electronic circuits.
EN508HS	**Advanced English Communication Skills Laboratory**	C310.1	Improve listening comprehension and critical reading skills through structured practice with audio clips and reading passages.
		C310.2	Develop effective writing skills for academic, professional, and social contexts including reports, résumés, letters, blogs, and e-mails.
		C310.3	Gain confidence and competence in oral communication through structured presentations, role plays, and group discussions.
		C310.4	Participate actively and effectively in Group Discussions by demonstrating fluency, clarity, and proper body language.
		C310.5	Prepare for and perform well in interviews using appropriate strategies and effective communication techniques, including mock interviews.
***MC510**	**Intellectual Property Rights**	C311.1	Understand the fundamentals of Intellectual Property Rights and the role of international organizations and treaties.
		C311.2	Explain the purpose, function, and processes of trademark protection and registration.
		C311.3	Gain knowledge of copyright and patent laws, including rights, registration, and ownership.
		C311.4	Analyze legal issues related to trade secrets, unfair competition, and litigation aspects.
		C311.5	Examine recent developments and international perspectives in IPR and conduct IP audits.

III Year II-Sem			
MT601OE	**RENEWABLE ENERGY SOURCES (Open Elective – I)**	C312.1	Understand and analyze renewable energy sources, energy economics, and modern electronic control techniques in power systems.
		C312.2	Explain photovoltaic systems and fuel cells, including their characteristics, applications, and economic aspects.
		C312.3	Analyze the operation, control, and economic considerations of induction generators for renewable energy applications.
		C312.4	Describe various energy storage technologies and evaluate their role and economic impact in power systems.
		C312.5	Understand grid integration and interconnection standards of renewable energy sources.
EE612OE	**FUNDAMENTAL OF ELECTRIC VEHICLES (Open Elective-I.2)**	C313.1	Understand the fundamentals of electric vehicles (EVs), their subsystems, India's EV initiatives, and charging/swapping infrastructure.
		C313.2	Analyze vehicle dynamics including forces on a moving vehicle and drive cycle energy requirements.
		C313.3	Evaluate the design and working of EV powertrains, lithium-ion battery technologies, and battery pack development.
		C313.4	Understand EV motors, their control mechanisms, and the thermal and electrical design considerations.
		C313.5	Explore various EV charging techniques, infrastructure types, standardization, and economic viability of public charging systems.
EE622PE	**POWER SEMICONDUCTOR DRIVES(PE-2)**	C314.1	Analyze and control the operation of DC motors using single-phase and three-phase controlled converters.
		C314.2	Understand four-quadrant operation of DC drives and control of DC motors using chopper circuits with speed-torque analysis.
		C314.3	Explain speed control methods of induction motors using AC voltage controllers, inverters, and cyclo-converters.
		C314.4	Examine rotor side control techniques for induction motors including slip power recovery and static drives.
		C314.5	Understand control techniques of synchronous motors with various inverter-fed drives and analyze their speed-torque characteristics.

EE623PE	**WIND AND SOLAR ENERGY SYSTEMS (Professional Elective-II.3)**	C315.1	Understand the physics of wind power, statistical modeling of wind speed, and control strategies such as stall and pitch control.
		C315.2	Analyze various wind turbine generator technologies and converter topologies used in wind energy systems.
		C315.3	Evaluate solar radiation geometry and apply PV technologies, V-I characteristics, and MPPT algorithms.
		C315.4	Identify integration issues and technical challenges in connecting wind and solar systems to the grid, including fault handling and power quality.
		C315.5	Understand solar thermal power generation technologies and perform basic analysis of different thermal systems.
EE601PC	**Digital Signal Processing**	C316.1	Understand fundamental concepts of discrete-time signals, systems, and digital filter realizations using difference equations and Z-transforms.
		C316.2	Apply Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT) algorithms to analyze and process discrete signals efficiently.
		C316.3	Design and analyze Infinite Impulse Response (IIR) digital filters using analog filter approximations and digital transformation techniques.
		C316.4	Design and evaluate Finite Impulse Response (FIR) digital filters using various design methods and compare with IIR filters.
		C316.5	Analyze multi-rate digital signal processing techniques including sampling rate conversion and resampling applications.
EE602PC	**Power System Protection**	C317.1	Explain the need, classification, and construction of protective relays.
		C317.2	Analyze over-current and distance protection schemes used in transmission systems.
		C317.3	Describe pilot relaying schemes and protection of generators, transformers, and busbars.
		C317.4	Evaluate static and microprocessor-based relays with comparators and relay characteristics.
		C317.5	Understand circuit breaker types, arc interruption theories, and fuse applications.
EE603PC	**Power System Operation and Control**	C318.1	Analyze power system load flow using Gauss-Seidel, Newton-Raphson, and Fast Decoupled methods.
		C318.2	Evaluate the economic operation of power

			systems including transmission loss minimization.
		C318.3	Develop models for automatic load frequency (P-f) and voltage control (Q-V) systems.
		C318.4	Assess and improve the stability of power systems using analytical techniques.
		C318.5	Explain SCADA and EMS systems and their role in power system control and monitoring.
EE604PC	**Power System Laboratory**	C319.1	Analyze the operating characteristics of protective relays like IDMT and over/under voltage relays.
		C319.2	Implement and test differential protection schemes for single-phase transformers.
		C319.3	Evaluate sequence impedances of synchronous machines and transformers.
		C319.4	Determine A, B, C, D constants of long transmission lines and analyze power flow.
		C319.5	Perform load flow studies using Gauss-Seidel and Fast Decoupled methods.
EE605PC	**Control Systems Laboratory**	C320.1	Analyze time response characteristics of second-order systems and the effects of feedback.
		C320.2	Determine transfer functions of DC motors and generators using experimental setup.
		C320.3	Evaluate the operation and characteristics of synchro's and AC/DC servo motors.
		C320.4	Implement logic gate functions, Boolean expressions, and PLC-based motor speed control.
		C320.5	Design and analyze compensators and PID controllers using both hardware and simulation tools.
EE606PC	**Digital Signal Processing Lab**	C321.1	Implement basic DSP operations such as DFT, IDFT, FFT, and Power Spectrum using simulation tools.
		C321.2	Design and analyze FIR and IIR filters for signal processing applications.
		C321.3	Perform multirate signal processing including interpolation and decimation.
		C321.4	Analyze and generate signals such as sinusoidal, DTMF, and filtered signals.
		C321.5	Apply DSP techniques for real-time audio applications and noise reduction using software tools.
CS612OE	**DATABASE MANAGEMENT SYSTEMS (Open Elective – I)**	C322.1	Understand the structure, design, and purpose of database systems and ER modeling.
		C322.2	Apply relational algebra, relational calculus, and relational model concepts for database querying.
		C322.3	Develop SQL queries, constraints, triggers, and

			apply normalization techniques for schema design.
		C322.4	Analyze transaction management, concurrency control, and recovery techniques in database systems.
		C322.5	Understand and compare file organization methods and indexing techniques like B+ trees and hashing.
***MC609**	**Environmental Science**	C323.1	Understand the structure, functions, and importance of ecosystems.
		C323.2	Analyze the use and impact of natural resources and suggest sustainable practices.
		C323.3	Evaluate biodiversity, its threats, and conservation methods.
		C323.4	Identify types of pollution and control technologies; assess global environmental issues.
		C323.5	Interpret environmental legislation, policy, and EIA procedures for sustainable development.

PAC Coordinator **HoD**

JOGINPALLY B.R. ENGINEERING COLLEGE

Department of Electrical and Electronics Engineering

IV Year B.Tech. EEE

IV Year I-Sem			
EE701PC	**Power Electronic Applications to Renewable Energy Systems**	C401.1	Understand the characteristics and measurement of solar cells and apply MPPT techniques for optimal energy extraction.
		C401.2	Analyze inverter types and design components like batteries and inverters for various solar PV systems.
		C401.3	Describe wind energy principles, wind turbine technologies, and their economic and technical integration to the grid.
		C401.4	Develop models and control strategies for wind turbine generators using various generator technologies.
		C401.5	Explain the architecture, need, and challenges of hybrid energy systems integrating solar and wind power.
EE721OE	**UTILIZATION OF ELECTRIC ENERGY (Open Elective-II.1)**	C402.1	Understand and explain various methods of electric heating, their advantages, and applications.
		C402.2	Describe electric welding processes, compare AC and DC welding, and explain electrolysis and metal processing.
		C402.3	Explain illumination principles, types of lamps, lighting calculations, and design schemes for different applications.
		C402.4	Analyze electric traction systems, their mechanics, speed-time curves, energy consumption, and system comparisons.
		C402.5	Describe train lighting systems, their requirements, and methods to maintain unidirectional polarity and constant output.
EE722OE	**ENERGY STORAGE SYSTEMS (Open Elective-II.2)**	C403.1	Understand the fundamental roles of electrical energy storage technologies in modern electricity systems.
		C403.2	Identify and compare different types of electrical energy storage systems along with their features.
		C403.3	Analyze various practical applications of energy

			storage systems in utility, consumer, and renewable sectors.
		C403.4	Explain the management, control, and integration of energy storage systems within power grids and microgrids.
		C403.5	Forecast the market potential and future trends of energy storage technologies globally.
EE731PE	**MOBILE APPLICATION DEVELOPMENT (Professional Elective-III.1)**	C404.1	Understand the architecture, design, and components of the Android Operating System and development framework.
		C404.2	Develop user interfaces using various Android layout managers and UI components, handling user events effectively.
		C404.3	Implement inter-component communication in Android using Intents, Broadcast Receivers, and Notifications.
		C404.4	Manage persistent storage in Android applications using files, shared preferences, and SQLite databases.
		C404.5	Create robust Android applications with multi-screen support, lifecycle management, and data handling techniques.
EE732PE	**SIGNALS AND SYSTEMS (Professional Elective-III.2)**	C405.1	Understand and analyze different types of signals and system properties including linearity, causality, and stability.
		C405.2	Analyze continuous and discrete-time Linear Time Invariant (LTI) systems using impulse response, convolution, and state-space methods.
		C405.3	Apply Fourier series and Fourier transform techniques for signal representation and system analysis in time and frequency domains.
		C405.4	Utilize Laplace and Z-transforms for solving differential and difference equations and system function analysis.
		C405.5	Comprehend sampling theorem, signal reconstruction, aliasing effects, and their practical applications in communication and control systems.
EE701PC	**POWER ELECTRONIC APPLICATIONS TO RENEWABLE ENERGY SYSTEMS**	C406.1	Analyze solar PV cell characteristics and MPPT techniques.
		C406.2	Evaluate inverter types, battery sizing, and PV system classifications.
		C406.3	Understand wind energy systems, turbine types, and their grid integration.
		C406.4	Model and control various wind turbine generators and power converters.
		C406.5	Understand hybrid renewable energy systems

			and their grid integration challenges.
EE733PE	**ELECTRICAL AND HYBRID VEHICLES (PE – III)**	C407.1	Understand vehicle performance models and transmission characteristics of conventional vehicles.
		C407.2	Explain hybrid vehicle architectures, power flow control, and fuel efficiency analysis.
		C407.3	Analyze electric drive train topologies and control of various electric motor drives used in EVs and HEVs.
		C407.4	Evaluate different energy storage technologies and sizing of hybrid electric vehicle components.
		C407.5	Understand and compare energy management strategies and design considerations for hybrid and battery electric vehicles.
EE741PE	**HVDC TRANSMISSION (PE – IV)**	C408.1	Compare EHV AC and HVDC transmission systems, and describe the types of HVDC links and equipment.
		C408.2	Analyze the Graetz circuit for both rectifier and inverter modes, and evaluate the performance of 6-pulse and 12-pulse converters.
		C408.3	Explain the control principles of HVDC systems, including firing angle and extinction angle control, and perform AC/DC power flow analysis.
		C408.4	Describe the protection methods for HVDC systems, including surge arresters and smoothing reactors, and analyze converter faults.
		C408.5	Classify harmonics, calculate harmonic distortions, and design filters to mitigate adverse effects of harmonics.
EE742PE	**POWER SYSTEM RELIABILITY (Professional Elective-IV.2)**	C409.1	Understand basic probability distributions and reliability measures in engineering applications.
		C409.2	Analyze generation system reliability using various modeling and evaluation techniques.
		C409.3	Evaluate operating reserve and bulk power system reliability, including effects of interconnected systems.
		C409.5	Assess the reliability of distribution systems using appropriate reliability indices and performance metrics.
		C409.1	Analyze the impact of faults and maintenance strategies on substation and switching station reliability.
	EMBEDDED SYSTEMS	C410.1	Understand basic probability theory and its application to reliability engineering.

	APPLICATIONS (Professional Elective-IV.3)	C410.2	Analyze the reliability of simple and complex networks using different modeling approaches.
		C410.3	Apply probability distributions such as Poisson, exponential, and Weibull for system reliability.
		C410.4	Evaluate system reliability using Markov chains and continuous Markov processes.
		C410.5	Use frequency and duration techniques and approximate methods for evaluating system reliability.
EE702PC	**Fundamentals of Management for Engineers**	C411.1	Understand fundamental management concepts, functions, and evolving approaches.
		C411.2	Apply planning techniques and decision-making processes in managerial contexts.
		C411.3	Analyze organizational structures and human resource management strategies.
		C411.4	Evaluate leadership styles and motivational theories to enhance team performance.
		C411.5	Develop and implement control systems for effective organizational management.
EE703PC	**Simulation of Renewable Energy Systems Laboratory**	C412.1	Model and analyze the steady-state and dynamic behavior of photovoltaic, fuel cell, and wind energy systems.
		C412.2	Design and evaluate power converter topologies for both stand-alone and grid-connected renewable energy systems.
		C412.3	Implement and analyze maximum power point tracking (MPPT) algorithms for efficient energy harvesting.
		C412.4	Apply advanced power electronics techniques including power factor correction, switched capacitor converters, and ZVS/ZCS.
		C412.5	Develop solutions for integrating renewable energy sources with grid systems using modern compensation and control schemes.
EE704PC	**Project Stage - I**	C413.1	Apply theoretical knowledge to solve practical engineering problems encountered during the internship.
		C413.2	Demonstrate enhanced technical skills and the ability to use modern engineering tools in a real-world environment.
		C413.3	Exhibit professional ethics, effective communication, and teamwork in an industrial setting.
		C413.4	Develop innovative solutions and demonstrate creativity in addressing engineering challenges.
		C413.5	Prepare comprehensive reports and presentations reflecting the internship

			experience and learning

IV Year II-Sem			
EE831OE	**CHARGING INFRASTRUCTURE FOR ELECTRIC VEHICLES**	C414.1	Understand the fundamentals of electric vehicle charging and the components of EV battery chargers.
		C414.2	Analyze charger classifications, standards, and perform sizing and selection of appropriate chargers.
		C414.3	Comprehend and apply communication protocols used in EV chargers.
		C414.4	Design and plan public EV charging infrastructure considering safety, regulations, and business models.
		C414.5	Explore advanced EV charging technologies like wireless charging, battery swapping, and V2G integration.
EE832OE	**RELIABILITY ENGINEERING (Open Elective - III.2)**	C415.1	Understand basic probability theory and its application to reliability engineering.
		C415.2	Analyze the reliability of simple and complex networks using different modeling approaches.
		C415.3	Apply probability distributions such as Poisson, exponential, and Weibull for system reliability.
		C415.4	Evaluate system reliability using Markov chains and continuous Markov processes.
		C415.5	Use frequency and duration techniques and approximate methods for evaluating system reliability.
EE811PE	**POWER QUALITY AND FACTS (PE - V)**	C416.1	Identify and analyze power quality problems such as voltage sags, swells, harmonics, and flicker in distribution systems.
		C416.2	Explain and analyze the basics of AC transmission lines and apply passive reactive power compensation techniques.
		C416.3	Understand and evaluate static shunt compensators like SVC and STATCOM for reactive power control.
		C416.4	Describe and assess static series compensators such as TCSC, TSSC, and SSSC for series reactive power compensation.
		C416.5	Explain the principles and control methods of combined compensators, especially the Unified Power Flow Controller (UPFC).
EE852PE	**SOLAR POWER BATTERIES**	C417.1	Understand the basics of solar PV systems and the role, design, and operation of storage

	(Professional Elective-V.2)		batteries in PV systems.
		C417.2	Identify and differentiate between primary and secondary batteries used in solar applications.
		C417.3	Analyze coupling methods, degradation mechanisms, and design criteria for selecting solar batteries.
		C417.4	Evaluate cost factors, application-based selection, and system types (grid-tied vs. off-grid) for solar batteries.
		C417.5	Assess environmental impacts, efficiency metrics, and future trends in solar battery storage systems.
EE853PE	**AI TECHNIQUES IN ELECTRICAL ENGINEERING (Professional Elective-V.3)**	C418.1	Understand the fundamentals of neural networks, learning paradigms, and their role in artificial intelligence.
		C418.2	Analyze and implement different ANN paradigms such as MLP, SOM, FLN, and Hopfield networks.
		C418.3	Understand fuzzy logic principles, fuzzy set operations, and fuzzy inference systems.
		C418.4	Apply genetic algorithms to optimization problems and analyze their operators and convergence behavior.
		C418.5	Utilize AI techniques in electrical engineering applications such as load forecasting, power system control, and motor control.
EE861PE	**SMART GRID TECHNOLOGIES (Professional Elective-VI.1)**	C419.1	Understand the concept, evolution, functions, and challenges of smart grids.
		C419.2	Analyze the architecture, components, and automation systems of smart grid designs.
		C419.3	Apply computational and intelligent techniques for smart grid analysis and optimization.
		C419.4	Evaluate distributed generation technologies, microgrids, electric vehicles, and communication systems in smart grids.
		C419.5	Examine control strategies for smart grid operations including frequency, voltage, and reactive power management.
EE822PE	**ELECTRICAL DISTRIBUTION SYSTEMS (PE - VI)**	C411.1	Distinguish between transmission and distribution lines and design the feeders.
		C411.2	Compute power loss and voltage drop of the feeders.
		C411.3	Design protection of distribution systems.
		C411.4	Understand the importance of voltage control and power factor improvement.
		C411.5	Analyze and implement methods for compensation in power distribution systems

EE863PE	**MACHINE LEARNING APPLICATIONS TO ELECTRICAL ENGINEERING (Professional Elective-VI.3)**	C420.1	Understand the fundamentals, types, and evolution of machine learning and its relevance to EEE.
		C420.2	Apply foundational electrical engineering and signal processing concepts to machine learning tasks.
		C420.3	Perform data preprocessing and feature engineering for ML applications.
		C420.4	Implement and analyze ML algorithms including regression, classification, and clustering techniques.
		C420.5	Evaluate and apply machine learning techniques in electrical engineering domains through case studies.
EE801PC	**Project Stage – II including Seminar**	C421.1	Apply advanced engineering knowledge to design and develop comprehensive project solutions.
		C421.2	Conduct thorough research and utilize innovative approaches to address complex engineering challenges.
		C421.3	Demonstrate effective teamwork and communication skills in the execution of project tasks.
		C421.4	Exhibit professional and ethical responsibility in all aspects of project development.
		C421.5	Recognize the need for lifelong learning and demonstrate the ability to engage in continuous professional development.

PAC Coordinator **HoD**