

- **Department Name :- Electrical Engineering**
- **UG Program Name :-Electrical Engineering**
- **Vision and Mission :-**

Vision of the Department: Develop globally competent electrical engineers to serve future needs and challenges of the society

Mission of the Department: To impart technical education and research skills in close interaction with industry and society for the development of young minds, sensitive to ethical and environmental issues.

Sr. No.	Program Outcomes
1.	<b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2.	<b>Problem analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3.	<b>Design/development of solutions:</b> Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4.	<b>Conduct investigations of complex problems:</b> Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5.	<b>Modern tool usage:</b> Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6.	<b>The engineer and society:</b> Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7.	<b>Environment and sustainability:</b> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8.	<b>Ethics:</b> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9.	<b>Individual and team work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10.	<b>Communication:</b> Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11.	<b>Project management and finance:</b> Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12.	<b>Life-long learning:</b> Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest

	context of technological change
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Sr. No.	Program Specific Outcomes
1.	Apply knowledge of Power systems, Power electronics, Electrical machines and Control systems for the Industrial Applications
2.	Operate and control Renewable energy sources and Electric vehicle systems

S. Y. B. Tech.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
1	III	SH2093	Engineering Mathematics-III	CO1: Solve Linear Differential equations related to engineering application in electrical Engineering.
				CO2: Find and represent periodic functions using Fourier series.
				CO3: Apply rules of vector differential calculus to evaluate gradient, divergence and conservative vector field.
				CO4: Identify an appropriate probability distribution and use its properties to calculate probabilities
				CO5: Apply Laplace transform and Z-transform by using properties to various functions to solve electrical engineering problems.
2	III	EE2013	DC Machines and Transformer	CO1: Explain working principle and operation of single phase three phase transformer.
				CO2: Analyze working performance with different application of three phase transformer.
				CO3: Describe behavior of dc machine.
				CO4: Interpret characteristics of DC machines.
				CO5: Identify industrial applications and standards of DC machines and transformer.
3	III	EE2033	Electrical Circuit Analysis	CO1: Apply fundamental laws to analyze DC and AC circuits.
				CO2: Make use of different Theorems to evaluate steady state parameters of AC and DC circuits.
				CO3: Analyze the electrical two port network.
				CO4: Evaluate the circuit under transient condition.
				CO5: Design basic passive filters.
4	III	EE2053	Analog Electronics	CO1: Explain characteristics of diode and transistors.
				CO2: Analyze various diode circuits like rectifier, clipper and clamper.
				CO3: Apply dc and ac analysis to amplifier

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				circuits.
				CO4: Design sinusoidal and non-sinusoidal oscillators.
				CO5: Design operational amplifier based circuits.
5	III	EE2073	Electrical Measurement and Instrumentation	CO1: Demonstrate basic standards and concept of measuring instruments.
				CO2: Explain construction & working of various electrical measuring instruments.
				CO3: Discriminate the AC and DC bridges.
				CO4: Explain instrumentation of non- electrical quantities.
				CO5: Describe different types of Instrumentation systems
6	III	EE2513	DC Machines and Transformer Lab	CO1: Perform experiments on DC machines and transformers
				CO2: Plot the characteristics of various machines and solving engineering problems.
				CO3: Analyze the outcome and make interpretations of the machines.
				CO4: Analyze the parameters and predict the durability of the machines.
				CO5: Compare the performances of the machines by referring relevant standards.
7	III	EE2533	Electrical Measurement and Instrumentation Lab	CO1: Explain construction and working of various instruments.
				CO2: Determine the measurement of electrical parameters using various measurement techniques.
				CO3: Describe use of various digital measuring instruments.
				CO4: Describe the measurement techniques of non-electrical parameters.
8	III	EE2553	Analog Electronics Lab	CO1: Illustrate input & output response of analog electronic circuits and compare with theoretical values.
				CO2: Build diode circuits like rectifier, clipper & clamper.
				CO3: Design various applications of Op-Amp.
9	III	EE2573	Computer Programming Lab	CO1: Analyze the problem to find the objects and build Object Oriented Program.
				CO2: Elaborate the concepts of "Inline function", "Friend Function", "Function

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				Overloading” and “Operator Overloading”.
				CO3: Modify/Extend the program by using Inheritance.
				CO4: Use of memory management technique “Constructors” & “Destructors” to increase speed of program execution.
				CO5: Perform different operation of file like “Create”, “Open”, “Close” files and perform “Read”, “Write” and “Append”.
10	III	EE2593	Technical Aptitude -I	CO1: Apply the knowledge acquired during the course work.
				CO2: Develop the ability of problem solving.
11	III/IV	SH2633	Professional Leadership Skills	CO1: Explain the traits of a leadership through real life examples.
				CO2: Exhibit the ability to work effectively in team.
				CO3: Prepare a presentation as per the audience and context requirements.
12	III/IV	SH2613	Interpersonal Skills (‘Jeevanvidya’ for Work Life Balance)	CO1: Exhibit interpersonal communication skills.
				CO2: Demonstrate decision-making skills.
				CO3: Apply conflict resolution styles appropriate in different situations.
				CO4: Demonstrate skills to manage balance in work and life.
				CO5: Apply Jeevanvidya wisdom in day to day life.
13	III/IV	SH2693	Innovation Tools and Methods for Entrepreneurs	CO1: Explain structured approach to define the problem with every possible detail, identify conflicts and solve them
				CO2: Apply User Journey Map to the selected problem to show user interaction at various stages
				CO3: Analyze the solutions provided by competitors for effectiveness and gaps if any.
14	III/IV	SH2593	Personal Effectiveness and Body Language	CO1: Develop skills to build self-esteem and positive attitude.
				CO2: Develop interpersonal skills characterized by effective communication and conflict resolution.
				CO3: Discover ways to overcome procrastination.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				CO4: Demonstrate responsiveness towards stress and health issues.
				CO5: Interpret the non-verbal behavior of a person.
15	III	SH2733	German Language- Basic Level	CO1: Interpret the language if the next person is speaking slowly and clearly.
				CO2: Make use of the language in routine life with the routing topics like family, shopping, work etc.
				CO3: Demonstrate the language by self-introduction in German with simple sentences.
16	III	SH2713	Japanese Language - Level III	CO1: Make use of basic conversations in various situations.
				CO2: Identify the sentence patterns.
				CO3: Explain insights about the communication required for living in Japan.
				CO4: Interpret Japanese work ethics required in their professional career.
17	III	EE2023	AC Machines	CO1: Describe behavior of three phase and single phase induction motors.
				CO2: Discover various characteristics of three phase induction motor.
				CO3: Identify various industrial applications for single phase and three phase Induction Motor.
				CO4: Describe construction, working principle along with winding details of Synchronous Generator.
				CO5: Analyze performance characteristics and testing of Synchronous Machine.
18	III	EE2043	Power Transmission and Distribution Systems	CO1: Summarize structure of power sector in India.
				CO2: Calculate various transmission line parameters.
				CO3: Select various components of overhead transmission lines and cables
				CO4: Explain various phenomena during operation of power network.
				CO5: Choose distribution systems which gives minimum loss.
19	III	EE2063	Digital Electronics	CO1: Describe the fundamental concepts and techniques used in digital electronics.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				CO2: Construct any Boolean function using logic gates by applying logic function minimization techniques.
				CO3: Implement the given logical problems using logic gates
				CO4: Design combinational and sequential logic circuits.
				CO5: State the process of Analog to Digital conversion, Digital to Analog conversion and
				CO6: PLD to implement the given logical problem.
20	III	CE2263	Engineering Mechanics	CO1: Classify various forces and their effects, to analyze real life problems.
				CO2: Analyze engineering problems applying conditions of equilibrium.
				CO3: Determine Centroid & Moment of Inertia of the geometrical plane lamina
				CO4: Apply fundamental concepts of Kinematics and Kinetics to analyze practical problems.
21	III	SH2173	Environmental Science	CO1: Discuss the importance and sensitivity of environment.
				CO2: Interpret the over exploitation of natural resources and follow the environmental ethics.
				CO3: Explain methods to protect environment and prevent environmental pollution.
				CO4: Apply their knowledge and skills to solve environment related problems.
22	III	EE2523	AC Machine Lab	CO1: Perform experiments on AC machines (Asynchronous and Synchronous)
				CO2: Plot the characteristics of various machines and solving engineering problems.
				CO3: Analyze the outcome and make interpretations from test parameters.
				CO4: Analyze the parameters and predict the durability of the machines.
				CO5: Compare the performances of the machines by referring relevant standards.
23	III	EE2543	Digital Electronics Lab	CO1: Verify the truth table of different logic gates & Flip-flops.
				CO2: Implement desired Boolean functions using digital electronic components.
				CO3: Design combinational logic circuits & sequential logic circuits.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				CO4: Simulate and validate digital circuits using simulation tools such as Proteus, MultiSim
24	III	CE2283	Engineering Mechanics Lab	CO1: Compare coefficient of friction of various surfaces in contact.
				CO2: Correlate theoretical and practical results of support reactions and Centroid of plane lamina.
				CO3: Verify law of polygon of forces, law of triangle of forces and principle of moment
25	III	SH2603	Environmental Science project	CO1: Utilize scientific methods to solve environmental problems.
				CO2: Evaluate technologies for restoration of degraded environment.
				CO3: Develop presentation and report writing skills.
				CO4: Develop as an individual and in group leadership quality
26	III	EE2563	Technical Aptitude -II	CO1: Apply the knowledge acquired during the course work.
				CO2: Develop the ability of problem solving.
27	III/IV	SH2633	Professional Leadership Skills	CO1: Adequate knowledge of basic grammar of English language.
				CO2: Intermediate level vocabulary of English language.
				CO3: Ability to communicate moderately in English.
28	III/IV	SH2613	Interpersonal Skills ('Jeevanvidya' for Work Life Balance)	CO1: Exhibit interpersonal communication skills.
				CO2: Demonstrate decision-making skills.
				CO3: Apply conflict resolution styles appropriate in different situations.
				CO4: Demonstrate skills to manage balance in work and life.
29	III/IV	SH2693	Innovation Tools and Methods for Entrepreneurs	CO1: Explain structured approach to define the problem with every possible detail, identify conflicts and solve them
				CO2: Apply User Journey Map to the selected problem to show user interaction at various stages
				CO3: Analyze the solutions provided by competitors for effectiveness and gaps if any.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
30	III/IV	SH2593	Personal Effectiveness and Body Language	CO1: After successful completion of the course, students will be able to,
				CO2: Develop skills to build self-esteem and positive attitude.
				CO3: Develop interpersonal skills characterized by effective communication and conflict resolution.
				CO4: Discover ways to overcome procrastination.
				CO5: Demonstrate responsiveness towards stress and health issues.
				CO6: Interpret the non-verbal behaviour of a person.
31	III/IV	SH2643	German Language-Advanced Level	CO1: Interpret the language if the next person is speaking slowly and clearly.
				CO2: Make use of the language in routine life with the routing topics like family, shopping, work etc.
				CO3: Demonstrate the language by self-introduction in German with simple sentences.
32	III/IV	SH2623	Japanese Language - Level IV	CO1: To be able to make basic conversations in various situations.
				CO2: To recognize the sentence patterns.
				CO3: To improve Japanese Language proficiency.
				CO4: To give students insights about the communication required for living in Japan.
				CO5: To expose students to the Japanese work ethics required in their professional careers.

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Sr. No.	Semester	Course Code	Course Name	Course Outcome
1	V	EE3013	Electromagnetic Fields	CO 1. Apply coordinate systems to electric field in the context of divergence, curl and gradient.
				CO 2. Apply Coulomb's law, Gauss's law and divergence theorem.
				CO 3. Apply Biot- Savart law and Amperes circuital law to magneto static fields.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				CO 4. Evaluate Maxwell's equations for time varying fields derived from Faradays and Amperes law.
				CO 5. Develop electromagnetic wave equations for free-space, dielectric and conductors
2	V	EE3033	Power System Analysis	CO 1. Analyze power system components using per unit system.
				CO 2. Examine symmetrical components used in power system
				CO 3. Estimate symmetrical and unsymmetrical faults in power system
				CO 4. Inspect power system transient stability.
				CO 5. Organize FACTS devices in power system for better operation.
3	V	EE3053	Control Systems	CO 1. Model different physical and other systems using different modelling techniques like transfer function, block diagrams, signal flow graphs etc.
				CO 2. Analyse the different systems using Time domain and Frequency domain tools and techniques.
				CO 3. Examine the stability of given LTI system.
				CO 4. Compare different controllers and compensators used in control systems.
				CO 5. Apply the knowledge of State Space techniques for analysing and understanding the MIMO systems.
4	V	EE3073	Microprocessor & Microcontroller	CO 1. Illustrate internal & external structure of microprocessor 8085 and Microcontroller 8051
				CO 2. Develop program for 8051 in assembly and C language
				CO 3. Make a use of timer, interrupt, and serial ports to

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				develop 8051 program
				CO 4. Design memory and I/O devices interfacing circuit to microprocessor and Microcontroller
				CO 5. Develop microcontroller-based real life applications
5	V	EE3093	Energy Storage Technologies	CO 1. Explain the energy storage as a structural unit of a power system.
				CO 2. Compare various energy storage technologies for power systems.
				CO 3. Apply energy storage based on hydrogen for power system.
				CO 4. Apply energy storage for short-term, mid-term and long-term applications
				CO 5. Analyze economics and reliability of energy storage Systems
6	V	EE3113	Restructured Power System	CO 1. Define reformation in Indian power sector
				CO 2. Identify new dimensions associated with the power system and its economics.
				CO 3. Compare the various operating mechanisms of conventional and restructured power system.
				CO 4. Interpret various aspects of power markets and market architecture.
				CO 5. Explain Transmission Congestion Management and Pricing in power sector
				CO 6. Propose ancillary services and bidding strategies in power sectors
7	V	EE3133	Digital Signal Processing	CO 1. Formulate signals mathematically in continuous, discrete-time and frequency domain.
				CO 2. Analyze discrete-time systems using z-transform.
				CO 3. Construct signals using Discrete-Fourier Transform (DFT) and FFT algorithms.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				CO 4. Design digital filters for various applications using various technique.
				CO 5. Apply digital signal processing for the analysis of real-life signals.
8	V	EE3153	Electrical Utilization and Traction	CO 1. Analyze electric heating for industrial application.
				CO 2. Demonstrate electric welding for industrial application.
				CO 3. Inspect electric circuits for refrigeration and air conditioning.
				CO 4. Evaluate the use of various process control techniques.
				CO 5. Summarize electrical traction systems and drives.
9	V	EE3513	Control Systems Lab	CO 1. Test for responses of the mathematical model of different electromechanical systems for various standard inputs.
				CO 2. Evaluate time domain and frequency domain specifications of LTI systems
				CO 3. Examine the stability of LTI system using time domain and frequency domain techniques.
				CO 4. Design simple controller for LTI systems
				CO 5. Analyze state space models of LTI systems
10		EE3533	Microprocessors and Microcontroller Lab	CO 1. Writing assembly language programs for basic operations
				CO 2. Develop assembly language programs using subroutines & SFRs
				CO 3. Design interfacing circuits of various input output devices
				CO 4. Develop microcontrollers based real life prototype model
11	V	EE3553	Technical Aptitude -III	CO 1. Apply the knowledge acquired during the course work.
				CO 2. Develop the ability of problem solving.
12	V	SH3033	Scholastic Aptitude-I	CO 1. Develop a logical approach towards solving Aptitude and Reasoning problems.

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				CO 2. Analyze usage of basic aptitude terms of percentages, averages, ratios and applications of business aptitude terms of profits and interests
				CO 3. Develop a bridge in analogies, series and visualizing directions.
				CO 4. Apply various short cuts & techniques to manage speed and accuracy to get equipped for various competitive and campus recruitment exams
13		EE3573	Summer Internship (4 Weeks)	CO 1. Apply the Technical knowledge in real industrial situations.
				CO 2. Get exposure of industrial environment which create competent professionals for the industry.
				CO 3. Familiarization with specific Department/shop/function assigned to student.
				CO 4. Identify the industry problem on which they can do their final year project.
14	V	SH3011	Indian Constitution	CO 1. Create awareness about law depiction and importance of Constitution
				CO 2. Define Fundamental Rights and Fundamental Duties of the Indian Citizen to instill morality, social values, honesty, dignity of life and their social Responsibilities.
				CO 3. Create Awareness of their Surroundings, Society, Social problems and their suitable solutions while keeping rights and duties of the citizen keeping in mind.
				CO 4. Recognize distribution of powers and functions of Local Self Government.
				CO 5. Comprehend the National Emergency, Financial Emergency and their impact on Economy of the country.
15	VI	EE3023	Power System Operation and Control	CO 1. After successful completion of the course, students will be able to,

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				CO 2. Make use of different economic tools for the power system operation.
				CO 3. Analyze economic load dispatch for the power system
				CO 4. Compare different power flow methods
				CO 5. Model load frequency control for power system.
				CO 6. Analyze voltage control and voltage stability for power system
16	VI	EE3043	Power Electronics	CO 1. Compare performance of various power electronic switches.
				CO 2. Analyze the performance of uncontrolled rectifiers and phase-controlled converters
				CO 3. Design DC-DC converters for different type of loads.
				CO 4. Analyze the performance of different types of inverters and AC-AC converters.
				CO 5. Suggest suitable power electronic converters for specific application
17	VI	EE3063	Electrical Energy Conservation and Auditing	CO 1. Measure the energy conservation/saving opportunities in different electric system.
				CO 2. Select energy conservation opportunities in thermal system.
				CO 3. Demonstrate skills required for energy audit and management.
				CO 4. Prepare energy flow diagrams and energy audit report.
				CO 5. Judge cost-effective measures towards improving energy efficient and energy conservation
18	VI	EE3083	Electric and Hybrid Electric Vehicles	CO 1. Discuss Conventional Vehicles and Powertrains
				CO 2. Analyse the electric drive mechanism.
				CO 3. Investigate Battery Management Systems
				CO 4. Classify hybrid electric vehicles

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				CO 5. Describe plug-in hybrid electric vehicles and electrical infrastructure.
19	VI	EE3103	Advanced Control Systems	CO 1. Design compensators for LTI systems.
				CO 2. Design state feedback controller and observer for the system models.
				CO 3. Examine stability of the state space models.
				CO 4. Analyze discrete time systems
				CO 5. Examine stability of discrete time systems
20	VI	EE3123	Applications of Microcontrollers in Electrical Engineering	CO 1. Explain architecture, memory organization and essential features of PIC18F458 microcontroller
				CO 2. Write program for PIC microcontrollers in assembly language for specific applications.
				CO 3. Implement CCP module of PIC in various modes for generation of waveforms, period measurement of unknown signal and speed control of DC motor
				CO 4. Develop a logic to interface PIC microcontroller to various peripheral devices
				CO 5. Design microcontroller based system using advanced microcontroller for electrical engineering related applications.
21	VI	OE3163	Engineering Materials	CO 1. Define and chose various engineering materials.
				CO 2. Classify, compare, illustrate and demonstrate the properties and behavior of materials.
				CO 3. Identify, construct, experiment and make use of various materials.
				CO 4. Examine, distinguish and analyze behavior based on the functioning of materials.
				CO 5. Estimate, interpret, judge various material and possibly make use for creative products.
22	VI	OE3181	Industrial Drives	CO 1. Analyze stability, moment of inertia, speed and torque in industrial drive system

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				CO 2. Explain energy conservation in industrial drive system
				CO 3. Discuss various sensors required for industrial drives.
				CO 4. Compare various control strategies for AC and DC drives
				CO 5. Select special motors for industrial applications
23	VI	SH3021	Biology for Engineers	CO 1. Apply biological engineering principles, procedures needed to solve real-world problems
				CO 2. Describe the functions of biological systems
				CO 3. Analyze biological phenomena and compute work done at microscale.
				CO 4. Explain working of different biomedical instruments
				CO 5. Select the sensors for given biological applications
				CO 6. Explain relevant aspect of movement control process.
24	VI	EE3523	Modelling and Simulation Lab	CO 1. Analyze rectifier circuits using PSIM and MATLAB software.
				CO 2. Make use of MATLAB programming and the Simulink platform to solve different problems.
				CO 3. Analyze the power system analysis problem using MATLAB toolbox
				CO 4. Develop a power system network in ETAP software to solve power flow analysis problems.
				CO 5. Develop a power system network in CYME Power software to solve power flow analysis problems.
				CO 6. Develop a power system network in GAMS software to solve power system problems.
25	VI	EE3543	Power Electronics Lab	CO 1. Demonstrate turn on & turn off schemes for semiconductor devices operated as power switches.
				CO 2. Demonstrate converter circuits connected to different

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				loads.
				CO 3. Analyze converter circuits connected to different loads.
				CO 4. Design various converters for specific applications
				CO 5. Simulate power electronic converters using MATLAB software.
26	VI	EE3563	Technical Aptitude -IV	CO 1. Apply the knowledge acquired during the course work.
				CO 2. Develop the ability of problem solving.
27	VI	EE3583	Capstone Project Phase -I	CO 1. Carry out literature survey and identify as well as select a problem.
				CO 2. Comprehend and analyze an engineering problem and report findings to provide an appropriate solution.
				CO 3. Design an experimental setup or develop an analytical model to analyze the system under consideration.
				CO 4. Communicate problem, methodology and outcomes systematically and effectively in the form of a technical report.
				CO 5. Work as a member and a team leader in engineering teams / multidisciplinary teams.
				CO 6. Demonstrate an ability to use different tools and techniques to solve the given problem.
28	VI	SH304	Psychology for Engineers	CO 1. Interpret human behavior as a system from a psychological perspective.
				CO 2. Appraise the various factors affecting human behavior at work.
				CO 3. Apply behavioral theories to manage/lead people and emotions at work.
29	VI	SH3063	Scholastic Aptitude-II	CO 1. Develop a logical approach towards solving Aptitude and Reasoning problems.
				CO 2. Analyze usage of basic aptitude terms of percentages, averages, ratios and applications

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				of business aptitude terms of profits and interests
				CO 3. Develop a bridge in analogies, series and visualizing directions.
				CO 4. Apply various short cuts & techniques to manage speed and accuracy to get equipped for various competitive and campus recruitment exams
Sr. No.	Semester	Course Code	Course Name	Course Outcome
1.				Co:1
				Co:2
2.				Co:1
				Co:2
				Co:3

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Sr. No.	Semester	Course Code	Course Name	Course Outcome
1.	VII	EE4013	Power System Protection	Explain different types of power system faults.
				Elaborate the different protective devices
				Describe Relays for power system protection.
				Explain different circuit breakers as per their application
				Illustrate the proper earthing system and selection of Lightning arrester
2.	VII	EE4033	Electrical Drives	List the parts of electrical drives, advantages and factors affecting the choice of electrical drives.
				Interpret the equivalent parameters, stability and components of load torque for a given motor-load system.
				Apply power electronics converter and their control techniques to control dc drives.
				Estimate the performance parameters of dc drives controlled by rectifiers and choppers.

				Describe stator side and rotor side control of induction motor drive.
				Explain the special motor drives for industrial applications.
3.	<b>VII</b>	<b>EE4053</b>	<b>Power System Dynamics and Control</b>	Compare various methods to enhance power system stability.
				Develop dynamic modeling of a synchronous machine, excitation system, speed governing system, and transmission line.
				Identify the impact of stability on power system planning, and operation.
				Outline stability issues in interconnected power system.
				Analyze Power system stabilizer.
4.	<b>VII</b>	<b>EE4073</b>	<b>HVDC Transmission Systems</b>	Elaborate HVDC system and describe various types of DC links
				Analyze Line Commutated Converters and Voltage Source Converters in HVDC Transmission System with their control methods
				Explain various faults and protection methods for HVDC transmission systems
				Describe impact of Reactive power, Harmonics and filters in HVDC system
				Illustrate HVDC components modeling and AC/DC power flow
5.	<b>VII</b>	<b>EE4093</b>	<b>Nonlinear Control Systems</b>	List different types of non-linearities present in the system
				Analyze non-linear systems using analytical and graphical methods
				Comment on the stability of nonlinear systems using various approaches.
				Apply Lyapunov stability criteria for nonlinear system
				Develop mathematical model of real-time nonlinear systems
6.	<b>VII</b>	<b>EE4113</b>	<b>FACTS Controllers</b>	Examine the importance of controllable parameters and benefits of FACTS Controllers.
				Compare the operation of SVC and

				<p>STATCOM</p> <p>Analyze the functional operation and control of series compensation</p> <p>Describe the principles, operation and control of voltage &amp; Phase angle regulator</p> <p>Explain combined &amp; special purpose FACTS controllers</p>
7.	<b>VII</b>	<b>EE4133</b>	<b>High Voltage Engineering</b>	<p>Identify and analyze the breakdown theories of solid, liquid and gaseous materials</p> <p>Describe as well as use different methods of generation of high AC, DC, impulse voltage and current.</p> <p>Demonstrate and use different methods of measurement of high AC, DC, impulse voltage and current</p> <p>Identify the occurrence of overvoltage and to provide remedial solutions</p> <p>Demonstrate an ability to carry out different tests on high voltage equipment and devices as well as ability to design the high voltage laboratory with all safety measures</p>
8.	<b>VII</b>	<b>EE4153</b>	<b>Power Quality and Harmonics</b>	<p>Discuss various power quality problems and their analysis.</p> <p>Describe Power Quality Standards and Monitoring</p> <p>Asses sources of harmonic in power system</p> <p>Analyze effects of Harmonics on Power system</p> <p>Explain harmonic filters</p>
9.	<b>VII</b>	<b>EE4173</b>	<b>Smart Grids</b>	<p>Summarize the concept and future of smart grid</p> <p>Develop smart grid architecture</p> <p>Compile various smart grid technologies</p> <p>Identify communication and information technologies for smart grid</p> <p>Elaborate distribution generation technologies</p> <p>Recommend smart metering and distribution automation</p>

				equipment's
10.	VII	EE4193	FPGA DSP Processors	Explain the basic functions of FPGA DSP processors.
				Interpret the modules of DSP processors
				Compare FPGA based DSP technologies
				Elaborate FPGA implantation tools and its synthesis
				Develop architecture of FPGA based DP systems
11.	VII	EE4213	Computer Modeling of Electrical Power System	Develop mathematical models and write a suitable computer program for power system network.
				Develop a computer program for complex linear transformation and compound admittance technique.
				Formulate AC and AC-DC power system analysis problem.
				Apply various methods of load flow studies to AC power system network and write a suitable computer program.
				Analyse AC-DC network and develop suitable computer program for power flow analysis.
12.	VII	EE4233	Power System Optimization	Explain the need of power system optimization.
				Formulate power system optimization problem.
				Apply numerical and heuristic technique to solve power system optimization problem.
				Solve power system optimization problem.
				Assess the impact of parameters on defined optimization problem
13.	VII	EE4253	Advanced Power Electronics	Design mathematical model of various converters.
				Analyze AC voltage controllers and resonant converters.
				Describe Switched mode power converters.
				Apply knowledge of inverters for various electrical applications
				Select power electronic conditioners and filters for Power Quality Improvement.

14.	<b>VII</b>	<b>EE4273</b>	<b>Battery Management System</b>	Discuss BMS for various applications.
				Compare various batteries for specific applications
				Illustrate battery parameters and battery testing
				Explain battery management methods for a given system
				Illustrate thermal management and aging of batteries for electric vehicles
15.	<b>VII</b>	<b>EE4513</b>	<b>Power System Protection Laboratory</b>	Explain different types of power system schemes.
				Compare the Electromagnetic, static and microprocessor based relays
				Describe Current-time and voltage-time characteristics of relays.
				Demonstrate faults on power system fault simulation panels
				Illustrate the proper earthing system and safety precautions in Electrical systems
16.	<b>VII</b>	<b>EE4533</b>	<b>Electrical Drives Lab</b>	Demonstrate AC and DC drives, fed from various power electronics converters
				Examine closed loop control of electrical drive system
				Analyze performance of electrical drives by plotting speed-torque characteristics
				Compare performance of electrical drives using speed-torque characteristics
				Simulate AC and DC drives, fed from various power electronics converters
17.	<b>VII</b>	<b>EE4553</b>	<b>Wind Solar Lab</b>	Prepare report on wind resource assessment
				Operate and maintain squirrel cage and DFIG based systems.
				Compute reactive power requirement for standalone wind turbine system
				Demonstrate the effects of shadowing on PV modules
				Identify the installation materials for off grid PV systems
18.	<b>VII</b>	<b>EE4573</b>	<b>Control and Automation</b>	Design relay logic-based control system for the given

			<b>Lab</b>	<p>applications.</p> <p>Implement IEC based programming languages for various PLCs</p> <p>Develop Relay Logic Ladder for the real-time PLC based control applications.</p> <p>Study SCADA based GUI system for the real time applications.</p> <p>Use HMI to develop GUI based monitoring system of the real time applications.</p>
19.	<b>VII</b>	<b>EE4593</b>	<b>Capstone Project Phase-II</b>	<p>Devise sound technical knowledge, for identified problem of project.</p> <p>Propose engineering solution to complex problems.</p> <p>Demonstrate the skills and attitude in professional way in a team.</p> <p>Illustrate the component and cost optimization solutions wherever applicable.</p> <p>Develop skills towards the use of modern tools and presentations.</p> <p>Justify outcomes through simulation/ experimentation in environmental and sustainable way.</p> <p>Summarize project report in an ethical way</p>
20.	<b>VIII</b>	<b>OE4381</b>	<b>Finance for Engineers (Online Course)</b>	<p>Discuss the fundamental aspects of accounting and finance.</p> <p>Apply theoretical knowledge and information for preparing various financial statements.</p> <p>Analyze the financial information for solving managerial problems.</p> <p>Evaluate financial performance of the organization for effective decision making.</p>
21.	<b>VIII</b>	<b>OE4361</b>	<b>Engineering Management &amp; Economics (Online Course)</b>	<p>Develop administrative, organizational and planning skills to execute engineering project.</p> <p>Develop bar chart/mile stone chart for the project.</p> <p>Analyze profit/cost data and</p>

				<p>carry out economic analysis to take optimal decision.</p> <p>Calculate depreciation as per various methods.</p>
22.	<b>VIII VIII</b>	<b>IP4023</b>	<b>Internship &amp; Project</b>	<p><b>Internship</b></p> <p>Examine the functioning of the company on the terms of inputs, transformation process and the outputs (products and services)</p> <p>Develop an attitude to adjust with the company culture, work norms, code of conduct.</p> <p>Recognize and follow the safety norms, Code of conduct.</p> <p>Demonstrate the ability to observe, analyse and document the details as per the industry practices.</p> <p>Interpret the processes, systems and procedures and to relate to the theoretical concepts- studies.</p> <p>Develop the leadership abilities, communication.</p> <p>Demonstrate project management and finance sense</p> <p><b>Project</b></p> <p>1. Identify the project/problem in the domain of a program relevant for the company.</p> <p>2. Compile the information to the pertaining to the problem identified.</p> <p>3. Analyse the information using the statistical tools/ techniques.</p> <p>4. develop the feasible solution for given problem.</p> <p>5. Analyse the impact of the project on the performance of company/department.</p>
23.	<b>VIII</b>	<b>RE4043</b>	<b>Research Project</b>	<p>Investigate the technical literature.</p> <p>Recognize and evaluate theories, practices, and/or research on a chosen topic by conducting a thorough literature review and submitting a written integrative, critical summary of the current literature.</p> <p>Design a research problem and develop a methodology.</p> <p>Develop and implement an advanced original research or</p>

				creative project.
				Develop the ability to explain the conceptual viability of the project and describe the major components involved.
				Develop the ability to explain how the project will impact the relevant body of work.
				Develop advanced discipline-relevant skills and competencies.
				Construct an accurate record of research performed.
				Write a research report and paper.
24.	<b>VIII</b>	<b>ED4103</b>	<b>Project Management</b>	Prepare business Plan for selected business.
				Make risk analysis& market analysis of selected project.
				Make risk analysis& market analysis of selected project
				Make financial appraisal of selected project.
25.	<b>VIII</b>	<b>ED4043</b>	<b>Commercial Aspects of the Project</b>	Interpret basic Financial Terminologies.
				Prepare & analyze financial statements.
				Prepare financial Plan for venture.
				Apply basic principles of marketing for various products.
				Prepare market survey.
				Apply knowledge of marketing management for selected business.
26.	<b>VIII</b>	<b>ED4063</b>	<b>Entrepreneurship Development Program (EDP)</b>	Apply knowledge of engineering, economics, marketing and finance for formulation of business plan, starting & managing new business.
27.	<b>VIII</b>	<b>ED4083</b>	<b>Entrepreneurship Development Project</b>	Apply knowledge of engineering, economics, marketing and finance for preparation of project report.
				Make commercial, technical and financial appraisal of project.

- **Department Name: Electrical Engineering**

- **PG Program Name: Power System and Power Electronics**

- **Vision and Mission :-**

Vision of the Department: Develop globally competent electrical engineers to serve future needs and challenges of the society

Mission of the Department: To impart technical education and research skills in close interaction with industry and society for the development of young minds, sensitive to

- ethical and environmental issues.

Sr. No.	Program Outcomes
1.	To independently carry out research /investigation and development work to solve practical problems.
2.	To write and present a substantial technical report/document.
3.	To demonstrate a degree of mastery over the area of power systems and power electronics.
4.	To collaborate, work harmoniously in teams and address multidisciplinary issues with consideration of professional, legal, and ethical concerns.
5.	To use advanced techniques, skills, and modern engineering tools with financial aspects.
6.	To learn continuously, independently and update knowledge & skills

Course Code	Course	COs	Course Outcome
SH 515	Numerical Computational Techniques	CO1	Estimate the error.
		CO2	Apply the relevant numerical method for interpolating the polynomial
		CO3	Develop the equation to be fitted and fit the curve for given data
		CO4	Estimate numerically the solution of given algebraic equation.
		CO5	Use the relevant method for solving the simultaneous linear equations and compute the Eigen values.
		CO6	Construct the fuzzy set for given linguistic variable and apply fuzzy logic.
EPP1010	Computer Aided Power System Analysis	CO1	Develop mathematical models of various components of power system
		CO2	Identify different variables and constants associated with load flow studies
		CO3	Apply various methods of load flow studies to compute unknown variables
		CO4	Compare different methods of load flow studies
		CO5	Solve load flow problem by writing computer program .

Course Code	Course	COs	Course Outcome
EPP1020	Electric and Hybrid Electric Vehicles	CO1	Discuss the trends and philosophy of electric vehicles
		CO2	Analyze Conventional Vehicles and Powertrains
		CO3	Discuss the electric drive mechanism.
		CO4	Classify hybrid electric vehicles
		CO5	Differentiate Electric and range-extended electric vehicles
		CO6	Describe plug-in hybrid electric vehicles and electrical infrastructure
EPP1030	Wind and Solar Energy Technology	CO1	Describe the principle of energy generation from wind and solar PV systems
		CO2	Formulate wind and solar energy systems by mathematical equations
		CO3	Assess energy produced from wind and solar energy systems.
		CO4	Compare the different methods of energy generation from wind and energy systems
		CO5	Develop economic analysis of a wind turbine and solar PV systems
EPP1040	Advanced Power Electronics Systems	CO1	Classify different type's converters with respect to power output, configuration and application.
		CO2	Compare different types of power converters
		CO3	Describe the working principle of different types of power converters
		CO4	Model different types of power converters mathematically.
		CO5	Design pore converter for specific application.
EPP1050	Distribution Automation	CO1	Prepare layout of the substations and feeders considering load and desired voltage
		CO2	Design distribution system and associated equipment and devices.
		CO3	Identify an appropriate method of communication for any particular distribution system with a view of automation.
		CO4	Evaluate the economic aspects of any distribution system with automation
		CO5	Explain the importance of automation and SCADA
EPP1060	HVDC Transmission	CO1	Justify the need of HVDC Transmission system for power transmission
		CO2	Analyze different working modes of converters used for HVDC transmission
		CO3	Compare different control schemes employed

Course Code	Course	COs	Course Outcome
			for controlling HVDC system
		CO4	Compute the filter parameters for elimination of voltage and current harmonics in HVDC system
		CO5	Draw and compare different configuration multi-terminal HVDC system
EPP1070	Power Electronics Application to Power System	CO1	Classify different power electronics systems deployed for performance improvement of power system
		CO2	Analyze power quality issues in power system
		CO3	Identify suitable power electronic solutions for specific power system problems.
		CO4	Compare performance of different power electronics devices used for power system compensation problems
		CO5	Design suitable power electronic system for specific power system problem related to reactive power compensation
EPP1080	Smart Grid Technologies	CO1	Discuss the smart grid in Indian perspective
		CO2	Explain various smart grid technologies.
		CO3	Describe smart meters and advance metering infrastructure.
		CO4	Compare Smart grid and microgrid
		CO5	Apply power quality management in smart grid
		CO6	Identify communication technologies for smart grid
EPP1090	Power System Steady State Analysis Lab	CO1	Develop script to analyze symmetrical components using power system software.
		CO2	Analyze load flow and fault studies of given power system network using power system software.
		CO3	Develop MATLAB programme for power system optimization problem
		CO4	Develop estimation algorithm using least square methods.
		CO5	Use various power system software packages to analyze power system networks
EPP1100	Renewable Energy Lab	CO1	Prepare report on wind resource assessment
		CO2	Operate and maintain squirrel cage and DFIG based systems.
		CO3	Compute reactive power requirement for standalone wind turbine system
		CO4	Demonstrate the effects of shadowing on PV modules

Course Code	Course	COs	Course Outcome
		CO5	List the installation materials for off grid PV systems
EPP2010	Power System Dynamics and Stability	CO1	Describe power system operating states and control
		CO2	Analyze synchronous machine models
		CO3	Model excitation and prime mover system
		CO4	Classify power system stability
		CO5	Describe transient and voltage stability
EPP2020	Advanced Control of Electric Drives	CO1	Justify the need of closed loop drive system for industrial applications.
		CO2	Explain the working principle of different types of drive system.
		CO3	Compare different types of electric drives.
		CO4	Develop mathematical models of electric drive system for specific application.
		CO5	Design controllers for closed-loop operation of different types of electrical motors.
EPP2030	Grid Integration of Renewable Energy Sources	CO1	Summarize the grid codes for integration of renewable energy sources
		CO2	Explain the working principle of different power electronic topologies and controllers.
		CO3	Model mathematically renewable energy sources and associated control system
		CO4	Design systems to reduce impact of renewable energy fluctuations on grid
		CO5	Decide control strategy for PV renewable systems distribution system for voltage profile improvement
EPP2040	Digital Protection of Power Systems	CO1	Discuss the importance of power electronics devices in power system protection.
		CO2	Distinguish between conventional relays and modern relays
		CO3	Apply mathematical approach towards protection
		CO4	Develop algorithms for numerical protection
		CO5	Explore recent advances in digital protection of power systems
EPP2050	Power System Optimization	CO1	Explain the need of power system optimization
		CO2	Formulate power system optimization problem
		CO3	Apply numerical and heuristic technique to solve power system optimization problem.
		CO4	Solve power system optimization problem
		CO5	Assess the impact of parameters on defined optimization problem.

Course Code	Course	COs	Course Outcome
EPP2060	Restructured Power System	CO1	Describe the new dimensions associated with the power systems.
		CO2	Determine transmission congestion management
		CO3	Discuss pricing of transmission network
		CO4	Explain ancillary service management in electrical market
		CO5	Justify the role and functions of PX, IEX and various organization in Indian restructured power market
EPP2070	Power Quality and Harmonics	CO1	Discuss various power quality problems and their analysis.
		CO2	Classify various voltage quality issues and solutions.
		CO3	Describe Power Quality Standards and Monitoring.
		CO4	Asses sources of harmonic in power system
		CO5	Analyze effects of Harmonics on Power system
		CO6	Design of harmonic filters.
EPP2080	Energy Storage Systems	CO1	Discuss the energy storage as a structural unit of a power system.
		CO2	Compare various energy storage technologies for power systems.
		CO3	Apply battery energy storage and management for power system.
		CO4	Describe hydrogen energy storage for power system.
		CO5	Discuss short-term, mid-term and long-term applications of power system.
		CO6	Analyze economics and reliability of energy storage Systems
EPP2090	Research Methodology and IPR	CO1	Formulate a research problem.
		CO2	Analyze research related information
		CO3	Prepare and present research proposal/paper by following research ethics
		CO4	Make effective use of computers and computing tools to search information, analyze information and prepare report.
		CO5	Describe nature and processes involved in development of intellectual property rights
EPP2100	Power System Protection Lab	CO1	Analyze characteristics of digital relays
		CO2	Demonstrate fault simulation on different protection panels
		CO3	Develop an algorithm for different protection schemes

Course Code	Course	COs	Course Outcome
		CO4	Simulate protection models in MATLAB, E-tap
		CO5	Interpret the simulation results
EPP2110	Advanced Electric Drives Lab	CO1	Demonstrate control of Induction motor drive.
		CO2	Experiment with chopper fed DC drive system.
		CO3	Experiment with three phase half and full converter fed DC motor drive.
		CO4	Demonstrate control of BLDC, servo and stepper motor drive system.
		CO5	Demonstrate control of AC and DC drives using MATLAB/SIMULINK.
SHP 551	Technical Communication	CO1	Acquire skills required for good oral and written communication
		CO2	Demonstrate improved writing and reading skills
		CO3	Ensure the good quality of oral and written communication
EPP2120	Mini Project	CO1	Formulate a real world problem.
		CO2	Design solution for a set of requirements.
		CO3	Use software packages available to analyze the proposed theory.
		CO4	Explain technical ideas, strategies and methodologies in written form and oral presentations
EPP3010	Industry Internship	CO1	Apply engineering knowledge learned during the program.
		CO2	Apply his/her technical skills to solve industrial problem.
		CO3	Work in multi-disciplinary environment.
EPP3020	MOOC Course	CO1	Identify the real applications and practices of courses studies, at industry level
		CO2	Recognize various modeling, analysis and validation techniques adopted at industries
		CO3	Demonstrate the issues at design, manufacturing and assembly levels
		CO4	Summarize and present technical data in report format
EPP3030	Dissertation Phase-I	CO1	Identify research opportunities in his/her domain or multidisciplinary domains.
		CO2	Formulate the problem statement and its objectives correctly
		CO3	Apply the principles of project management during development of the project
		CO4	Present report in logical order
		CO5	Write report of the system implementation

<b>Course Code</b>	<b>Course</b>	<b>COs</b>	<b>Course Outcome</b>
EPP3040	Dissertation Phase-II	CO1	Identify research opportunities in his/her domain or multidisciplinary domains.
		CO2	Formulate the problem statement and its objectives correctly
		CO3	Develop, simulate and implement the system by complying with desired technical specifications
		CO4	Analyze and synthesize obtained results in theoretical and practical context
		CO5	Present report in logical order
		CO6	Write report of the system implementation
EPP4010	Dissertation Phase –III	CO1	Formulate the problem statement and its objectives correctly
		CO2	Develop, simulate and implement the system by complying with desired technical specifications
		CO3	Analyze and synthesize obtained results in theoretical and practical context
		CO4	Present report in logical order
		CO5	Write report of the system implementation
		CO6	Apply the principles of project management during development of the project
EPP4020	Dissertation Viva-Voce	CO1	Formulate the problem statement and its objectives correctly
		CO2	Develop, simulate and implement the system by complying with desired technical specifications
		CO3	Analyze and synthesize obtained results in theoretical and practical context
		CO4	Present report in logical order
		CO5	Write report of the system implementation
		CO6	Apply the principles of project management during development of the project