- **Department Name :-_Electrical Engineering**

- **UG Program Name :- B.Tech Electrical Engineering**

- **Vision :**
  Develop professionally competent electrical engineers to serve future needs and challenges of the society in global environment.

- **Mission :-**
  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.	Apply knowledge of mathematics, science, and electrical engineering.
2.	Design and conduct experiments, as well as to analyze and interpret data.
3.	Design a system, components or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
4.	Function on multidisciplinary teams.
5.	Identify, formulate, and solve electrical engineering problems.
6.	Demonstrate professional and ethical responsibility.
7.	Communicate effectively at work.
8.	Understand the impact of electrical engineering solutions in global, economic, environmental, and societal context.
9.	Engage in life-long learning.
10.	Use the techniques, skills, and modern engineering tools necessary for engineering practice.
11.	Apply the knowledge to evaluate contemporary issues with project and finance management skills.
12.	Participate and succeed in competitive exams.

Sr. No.	Program Specific Outcomes
1.	Apply knowledge of circuits, machines, power electronics, power systems for the industrial automation and control applications
2.	Operate and control wind power, solar power and electric vehicle systems.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
1.	3	SH2091	Engineering Mathematics – III	CO1: Solve linear differential equations & problems related to application by using various methods. CO2: Determine expansion of functions by using Fourier series. CO3: Solve problems on probability distribution by using different formula. CO4: Determine Laplace transform & inverse Laplace transform of various functions by using properties. CO5: Laplace transform & apply Laplace transform to solve linear differential equations CO6: Calculate z- transform & inverse z-transform by using properties of z- transform
2.	3	EE2031	DC Machines and Transformer	CO1: Explain the working principle and operation of single phase and three phase transformer. CO2: Identify various industrial application for single phase and three phase transformer. CO3: Describe behavior of dc machines. CO4: Interpret characteristics of dc machines. CO5: Identify the importance of testing and control of dc machines with suitable industrial applications.
3.	3	EE2051	Electrical circuit analysis	CO1: Apply knowledge of mathematics, science, and engineering to the analysis and design of electrical circuits. CO2: Identify, formulate, and solve engineering problems in the area circuits and systems. CO3: Coordinate various components and process of electrical system to meet desired needs within realistic constraints. CO4: Explain importance of various network topology methods for computer analysis of large networks. CO5: Implement network reduction techniques to solve power system networks. CO6: Construct and organize various filter for specific circuits.
4.	3	EE2071	Analog Electronics	CO1: Explain the fundamentals of solid state electronics including diode, BJT, JFET & MOSFET. CO2: Apply dc & ac (small signal) analysis to solid state electronic circuits CO3: Design solid state electronic circuits. CO4: Analyze operational amplifier application circuits. CO5: Classify power amplifier circuits.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
5.	3	EE2091	Power system economics	CO1: Distinguish conventional and non-conventional energy sources. CO2: identify variable load on power stations and factors associated for per unit cost of energy generation. CO3: Choose various factors for cost of energy in terms different tariff. CO4: Determine different methods of power factor improvement. CO5: Compare different supply systems used in power system
6.	3	EE2511	DC Machines and Transformer Lab	CO1: Perform various experiments on DC machines. CO2: Perform various experiments on Transformer. CO3: Find out the characteristics of various machines along with their efficiencies. CO4: Analyze various parameters and predict the durability of the machines. CO5: Compare the performances of the machines by referring relevant standards
7.	3	EE2531	Electrical Circuits & Simulation Lab	CO1: Analyze responses of electrical circuits in real time. CO2: Design electrical networks using matlab/pspice etc. CO3: Compare responses of real-time electrical networks with simulations. CO4: Explain the importance of the virtual environment to analyze electrical networks. CO5: Implement various network reduction techniques for power system analysis and modeling.
8.	3	EE2551	Analog Electronics Lab	CO1: Build and analyze electronic circuits as per requirement. CO2: Observe input and output waveform at various test points. CO3: Plot the input & output response of electronic circuits. CO4: Interpret results of experiment and compare with theoretical values. CO5: Improve the ability to communicate effectively through written lab journals
9.	4	EE2021	Alternating Current Rotating Electrical Machines	CO1: Explain different types, construction, working principle & characteristics of three phase induction motors. CO2: Apply the knowledge gained through characteristics of three phase induction motor.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				CO3: Explain various types, construction, principle of operation, & application of single phase induction motor. CO4: Describe construction, working principle along with winding details of synchronous generator. CO5: Analyze performance, characteristics and testing of synchronous machine.
10.	4	EE2041	Power Transmission & Distribution System	CO1: Explain structure of power systems. CO2: Analyze various transmission line parameters and its mathematical modelling. CO3: Discover various design aspects of overhead transmission lines. CO4: Explain construction & classification of various underground cables. CO5: Classify various types of a.c and d.c. distribution systems
11.	4	EE2061	Electrical and Electronic Measurements	CO1: Demonstrate basic concept of calibration, statistical evaluation of measurement data. CO2: Explain construction & working of various electrical measuring instruments. CO3: Identify and demonstrate both electrical and electronic measuring instruments. CO4: Determine r, l, c parameters using ac and dc bridges. CO5: Explain construction and working of digital instruments.
12.	4	EE2081	Digital Electronics	CO1: Describe the fundamental concepts and techniques used in digital electronics. CO2: Formulate the logic expressions using boolean laws & k-map. CO3: Design and verify combinational logic circuits. CO4: Design and verify sequential logic circuits.
13.	4	EE2101	Signals and Systems	CO1: Classify various signals and systems. CO2: Analyze linear time invariant systems using different tools. CO3: Apply time and frequency domain analysis techniques to different signals and systems. CO4: Evaluate discrete time Fourier transform of a set of well-defined signals. CO5: Explain the need of signal processing techniques for various engineering fields.
14.	4	SH2011	Environmental Science	CO1: Interpret impacts of human activities on natural resources and its control measures. CO2: Apply ecological knowledge to solve environmental problems

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				CO3: Select the appropriate technology to control environmental pollution. CO4: Plan waste management and disaster management practices. CO5: Justify methods to assess impacts of developmental activities on environment. CO6; Analyze environmental change and its social impacts
15.	4	EE2521	A.C. Rotating Electrical Machines Lab	CO1: Perform various experiments on ac rotating machines. CO2: Analyze the characteristics of various ac machines along with their efficiencies. CO3: Analyze various parameters and predict the durability of the machine. CO4: Compare the performances of the machines by referring relevant standards. CO5: Identify proper machine for particular application. CO6: Study the constructional details of various electrical motors.
16.	4	EE2541	Electrical and Electronic Measurements Lab	CO1: Demonstrate calibration of various measuring instruments using statistical evaluation of measurement data. CO2: Determine power and energy for the given system using various measurement techniques. CO3: Explain construction and working of various instruments. CO4: Calculate r, l, c parameters using ac and dc bridges.
17.	4	EE2561	Digital Electronics Lab	CO1: Verify the truth table of digital electronic components CO2: Implement desired boolean functions using digital electronic components. CO3: Design and verify combinational logic circuits. CO4: Design and verify sequential logic circuits. CO5: develop and simulate digital circuits using simulation tools such as proteus, multisim etc
18.	4	EE2581	Mini Project (Environmental Science)	CO1: Utilize scientific methods to solve environmental problems CO2: Examine technologies for restoration of degraded environment CO3: Develop presentation and report writing skills CO4: Develop as an individual and in group leadership quality.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
19.	5	EE3011	ELECTROMAGNETIC FIELD THEORY	CO1: Define electric and magnetic fields according to their force effect. CO2: Understand the physical meanings of the differential equations for electrostatic and magneto static fields. CO3: Calculate the electric field from the stationary charge distributions and magnetic fields from steady current distributions. CO4: Describe and use simple models of electric and magnetic field interactions with materials CO5: Explain the concept of electromotive force, maxwell's equations and their physical meanings CO6: Analyze energy transportation and wave propagation in an electromagnetic field.
20.	5	EE3031	Power Electronics	CO1: Understand the behavior of semiconductor devices operated as power switches. CO2: Explain operation, waveform and performance parameters of phase controlled converters, uncontrolled rectifiers. CO3: Analyze and design ac-to-dc converters. CO4: Explain the basic topologies of dc-dc converters analyze and design dc-to-dc converters. CO5: Analyze and design dc-to-ac inverters. CO6: Apply the electronic devices for conversion, control and conditioning of power.
21.	5	EE3051	Power System Stability and Control	CO1: Analyze symmetrical faults in power systems. CO2: Apply symmetrical components method for fault analysis. CO3: Interpret the necessity of automatic generation control and excitation control. CO4: Analyze the optimal operation of power system. CO5: Analyze power system stability.
22.	5	EE3071	Feedback Control System	CO1: identify the basic elements and structures and demonstrate an understanding of the fundamentals of feedback control systems. CO2: Develop the mathematical models of any physical systems such as: state space, transfer function. CO3: Determine the response of different order systems for various standard signals. CO4: Interpret and analyze time domain systems using virtual environment.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				CO5: Interpret and analyze frequency domain systems using virtual environment.
23.	5	EE3091	Microprocessors and Micro controller	CO1: describe the architecture of microprocessor and micro-controller. CO2: write assembly language programs for 8085. CO3: explain a typical input-output interface. CO4: identify instruction addressing modes and syntax for 8051. CO5: create an assembly language or C program for 8051 that performs a prescribed task. CO6: design and implement a micro-controller-based embedded system.
24.	5	EE3511	Power Electronics Lab	CO1: Understand the behaviour, turn on & turn off schemes of semiconductor devices operated as power switches. CO2: Analyze, sketch, examine waveforms, and calculate measure performance factors of the output of ac-to-dc converters. CO3: Analyze, sketch, examine waveforms, and calculate measure performance factors of the output of dc-to-dc converters. CO4: Analyze, sketch, examine waveforms, and calculate measure performance factors of the output of dc-to-ac inverters CO5: Simulate, analyze and design power electronic circuits using matlab software.
25.	5	EE3531	Feedback Control Systems Lab	CO1: Solve the mathematical model of different electromechanical systems. CO2: Model any given electrical, mechanical system. CO3: Classify appropriate feedback signal, synthesis feedback gains and analyze their results and deduce the first and second order responses. CO4: Draw the root locus and analyze the system. CO5: Plot the bode, polar and nyquist plots and analyze frequency domain. CO6: Represent the system in state space and determine controllability and observability
26.	5	EE3551	Microprocessors and Micro controller Lab	CO1: create a template program, compile it, and then build the executable file. CO2: examine the effects of executing many of the 8085 and 8051 instructions by tracing the execution of a program in GNUSimulator and Keil for microprocessor and microcontroller respectively.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				CO3: write their own program in assembly language for 8085 and 8051. CO4: write the steps they go through to perform their tasks. CO5: apply their programming knowledge (assembly and C) for real time applications.
27.	5	EE3571	Seminar	CO1: Improve presentation and documentation skills. CO2: Apply theoretical knowledge to industrial problems and research assignment. CO3: Help contribute in analyzing, planning, and synthesizing problems in Electrical engineering
28.	5	SH3191	Scholastic Aptitude I	CO1: Develop a thorough conceptual understanding and develop a logical approach towards solving Aptitude and Reasoning Problems CO2: Understand usage of basic aptitude terms of percentages, averages, ratios and applications of business aptitude terms of profits and interests CO3: Develop a bridge in analogies, series and visualizing directions. CO4: Apply various short cuts & techniques to manage speed and accuracy to get equipped for various competitive and campus recruitment exams
29.	6	EE3021	Switch Gear and Protection	CO1: Explain fundamentals of different power system components CO2: Classify and explain the operation of circuit breakers and relays CO3: Discuss distance protection schemes. CO4: Determine the causes, effects and protective schemes for over-voltage and over-current relay. CO5: Describe different faults and devise protection schemes for generator and transformer
30.	6	EE3041	Control System Design	CO1: Design and tune proportional, integral and derivative controllers for given specifications. CO2: Design and tune proportional, integral and derivative controllers for given specifications. CO3: Design a suitable compensator in frequency domain for the given specifications. CO4: Design state feedback controller and observer for given system.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				CO5: Construct matlab models for the implementation of closed-loop systems.
31.	6	EE3061	Instrumentation Techniques	CO1: describe basic concepts of instrumentation and characteristics of instruments. CO2: Explain selection factors and application of transducers and sensors. CO3: Discuss different types of signal conditioning devices. CO4: Explain different data conversion techniques and digital instruments. CO5: Describe different type of industrial process controllers.
32.	6	EE3081	Electrical Drives and Control	CO1: Understand the stability, moment of inertia and torque in drive systems. CO2: Design block schematics of closed loop control of drives. CO3: Evaluate the motor rating for the given duty as per standard is4722. CO4: Explain the d.c. motor drives starting, braking and speed control operated from single phase and three phase converters. CO5: Solve the numerical problems on d.c. drives. CO6: Understand, analyze the operation of v/f, constant torque and constant power control of induction motor using different drives, vsi and csi. CO7: Understand the vector control of induction motor drives. CO8: Understand the operation speed control of synchronous motor drives.
33.	6	EE3101	Restructured Power System	CO1: Explain the needs and methods adopted for restructuring of power industry. CO2: Interpret the basics of economics and analyze the power markets using them. CO3: Discover the different paradigms of restructuring adopted in different countries. CO4: Explain the ideas of transmission open access and point out the needs of ancillary services and the methods adopted to provide them.. CO5: Analyze the implications of indian electricity act (2003). CO6: Identify the salient features of iegc and the organizational and administrative responsibilities of various organization involved in the power sector of india.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
34.	6	EE3121	Corporate ethics	CO1: Understand different approaches to legal ethics. CO2: Debate current ethical issues and think critically about existing practices. CO3: Apply ethical rules to practical scenario. CO4: Understand the moral and characterization to be an example of faith, character and high professional ethics
35.	6	EE3521	Control System Design Lab	CO1: Design and implement pid controller for a closed-loop system. CO2: Design a suitable compensator using root-locus technique. CO3: Design a suitable compensator in frequency domain. CO4: Develop state feedback controller and observer for siso system. CO5: Demonstrate control of closed-loop systems using matlab/hardware.
36.	6	EE3541	Switchgear and Protection Lab	CO1: Identify different switches and circuit breakers CO2: Observe and explain MCCB. CO3: Plot characteristics of Relays. CO4: Assure working of Relays based on their technology and characteristics. CO5: Discuss different protection schemes. CO6: Demonstrate for Transformer and Generator protection
37.	6	EE3561	Electrical Drives and Control Lab	CO1: Understand, demonstrate and sketch the speed- torque characteristics of electrical drives fed from power electronic converters. CO2: Understand, examine closed loop control of electrical drives. CO3: Apply simulation software for analyzing electrical drives. CO4: Calculate and measure the input, output parameters of electrical drives. CO5: Select the rating of motor of electrical drive for particular application according load duty as per is4722-1968. CO6: Evaluate the stability, analyze performance of electrical drives (a.c. and d.c. drives.) CO7: Understand advanced electrical drives srm, bldc, pmsm and examine their behavior using matlab/ simulink.
38.	6	SH3222	Scholastic Aptitude II	CO1: Develop a thorough conceptual understanding and develop a logical approach towards solving Aptitude and Reasoning Problems

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				CO2: Understand usage of aptitude terms of speed, time and distance and permutations, probabilities and applications. CO3: Understand blood relations and ways of seating arrangements along with various geometrical figures. CO4: Apply various short cuts & techniques to manage speed and accuracy to get equipped for various competitive and campus recruitment exams
39.	7	EE4021	Industrial organization and management	CO1:Apply the industrial management concepts, financial management concepts CO2: Contribute to the development, implementation, and evaluation of employee recruitment, selection, and retention plans and processes. CO3. Explain the importance of materials management function in an organization, and how it can help in integrating various plans and reduce the material related costs CO4: Design a marketing research study that will act as a key resource in the development of a marketing plan CO5:Explain industrial psychology and solve the industrial problems.
40.	7	EE4031	Electrical Machine Design	CO1: Calculate mmf and thermal rating of various types of electrical machines CO2: Design armature and field systems for d.c. machines CO3: Design core, yoke, windings and cooling systems of transformers. CO4: Design stator and rotor of induction machines. CO5: Design stator and rotor of synchronous machines and study their thermal behavior.
41.	7	EE4041	Automation and Control	CO1: Describe the need of industrial automation and their functions. CO2: Make use of standard iec programming languages. CO3: Design relay/rll based control logic for 11oolean expressions. CO4: Construct relay logic ladder diagram for the given application. CO5: Develop gui for monitoring system of the given real time applications using scada/hmi.
42.	7	EE4071	FACTS and HVDC	CO1: Understand the importance of controllable parameters and benefits of facts controllers.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				CO2: Analyse the functional operation and control of series and shunt compensation. CO3: Describe the principles, operation and control of multi-functional facts controller. CO4: Identify significance of dc over ac transmission system, types and application of hvdc links in practical power systems. CO5: Apply various methods of grid control for hvdc systems.
43.	7	EE4081	Power System Planning	CO1: Explain the need of power system expansion CO2: analyze the given power system for determining optimal values of decision variables. CO3: Apply mathematical tools to solve multi-objective optimization problems in expansion planning and reliability studies. CO4: Explain long term and short term planning. CO5: Discuss various economic analysis methods
44.	7	EE4521	Automation and Control Lab	CO1: Design relay logic control system for given application using relays. CO2: Develop rll for 12oolean expressions. CO3: Develop rll using timer and counter instructions. CO4: Develop rll using math instructions. CO5: Develop gui using scada/hmi for given application
45.	7	EE4531	Electrical Machine Design lab	CO1: Calculate various parameters required for design CO2: Design specific electrical machine as per requirement CO3: Apply and design the electrical machine in software
46.	7	EE4551	Project Phase I	CO1: Identify and analyze problems in the field of electrical engineering. CO2: Formulate and solve practical problems in electrical engineering in systematic way by applying suitable skills, tools and methodologies. CO3: Demonstrate the importance of working in teams with complementary skills. CO4: Disseminate knowledge by writing good technical report. CO5: Work in interdisciplinary project assignments.
47.	7	EE4571	Industry In-plant Training	CO1: To acquire and apply fundamental principles of engineering.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				CO2: Become updated with all the latest changes in technological world CO3: Develop ability to communicate efficiently CO4: Improve ability to identify, formulate and model problems and find engineering solution based on a systems approach CO5: Develop awareness of the social, cultural, global and environmental responsibility as an engineer
48.	7	EE4591	Operation of wind and solar system	CO1: Prepare report on wind resources assessment CO2: Operate and maintain squirrel cage and dfig based system CO3: Compute reactive power requirement for stand-alone wind turbine system CO4: Demonstrate the effect of shadowing on pv model CO5: List the installation materials for off grid pv system
49.	7	ED4001	BUSINESS OPPORTUNITY GUIDANCE	CO1: Generate & identify different business ideas. CO2: Make analysis of different ideas. CO3: Select proper business idea to suit his personality & competencies.
50.	7	RE0407	Research UROP Phase I	CO1: Perform literature review and identify research topic. CO2: Write synopsis of the research work that being done in semester viii. CO3: Write technical review paper.
51.				
52.	8	**Program Elective I** EE4011	High Voltage Engineering	CO1: Understand the basic generation and measurement of high voltage and high current for testing purposes CO2: Comprehend breakdown phenomenon in air, solid and liquid insulation CO3: Test high voltage electrical equipment with various testing devices CO4: Compare importance of different types of testing of high voltage plant. CO5: Discuss the overvoltage phenomena and insulation coordination in power system
53.	8	**Program Elective I** EE4051	Computer Modelling of Electrical Power System	CO1: Develop mathematical models of various components of power system CO2: Explain the modelling of power transmission plant. CO3: Develop mathematical expression of ac-dc conversion plant.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				CO4: Apply different numerical techniques to study power flow problem CO5: Compare iterative methods applied to solve power flow problem
54.	8	**Program Elective II** EE4061	Energy Audit and Management	CO1: Develop the concept and philosophy of energy conservation and management CO2: Decide the energy conservation and energy efficiency opportunities in the systems CO3: Solve material and energy balance problems CO4: Execute energy action plan CO5: Compute the energy saving potential in electrical and thermal utilities. CO6: Prepare detailed energy audit report of system or processes.
55.	8	**Program Elective II** EE4161	Power Quality Issues	CO1: Describe various categories of power quality problems. CO2: Classify power quality problems. CO3: Analyze the fundamental problems behind voltage regulation and correct them CO4: Explain the causes and solutions of power system harmonics. CO5: Analyze impact of distributed generation on power quality.
56.	8	**Open Elective II** OE432	Wind Energy Engineering	CO1: Apply fundamental principles of thermodynamics, fluid mechanics and mechanical systems to wind turbine engineering. CO2: Calculate various parameters related to wind turbine. CO3: Design of wind turbine components. CO4: Design in virtual environment. CO5: Work on team-based projects.
57.	8	**Program Elective I Laboratory** EE4511	High Voltage Engineering Lab	CO1: Apply knowledge of condition monitoring of transformer CO2: Test the dielectric properties of solid materials CO3: Test the dielectric properties of liquid and solid insulating materials. CO4: Explain the behavior of circuit breakers and transformer. CO5: Explain the behavior of impulse generator and lightning arrester.
58.	8	**Program Elective I Laboratory**	Computer Modelling of Electrical Power System Lab	CO1: Develop admittance matrix for the given system using system data CO2: Simulate power electronic converters for the given hvdc conversion plant CO3: Develop matlab programme to solve power flow problem for the given network

Sr. No.	Semester	Course Code	Course Name	Course Outcome
		EE4531		CO4: Use various application software packages to perform power flow study of given power system.
59.	8	EE4541	Project Phase -II	CO1: Identify and analyze problems in the field of electrical engineering. CO2: Formulate and solve practical problems in Electrical Engineering in systematic way by applying suitable skills, tools and methodologies. CO3: Demonstrate the importance of working in teams with complementary skills. CO4: Disseminate knowledge by writing good technical report. CO5: Work in interdisciplinary project assignments.
60.	VIII Option-2 RE0407 Undergraduate Research Experience (URE)			CO1. Investigate the technical literature. CO2. 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. CO3. Design a research problem and develop a methodology. CO4. Develop and implement an advanced original research or creative project. CO5. Develop the ability to explain the conceptual viability of the project and describe the major components involved. CO6. Develop the ability to explain how the project will impact the relevant body of work. CO7. Develop advanced discipline-relevant skills and competencies. CO8. Construct an accurate record of research performed. CO9. Write a research report and paper.
61.	VIII Option-3 LL0407 Industry Internship & Project			CO1. Examine the functioning of the company on the terms of inputs, transformation process and the outputs (products and services) CO2. Develop an attitude to adjust with the company culture, work norms, code of conduct. CO3. Recognize and follow the safety norms, Code of conduct. CO4. Demonstrate the ability to observe, analyze and document the details as per the industry practices. CO5. Interpret the processes, systems and procedures and to relate to the theoretical concepts- studies.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				CO6. Improve the leadership abilities, communication. CO7. Demonstrate project management and finance sense
62.	VIII Option-4 ED 4001 Entrepreneurship Development			CO1. Determine distinct entrepreneurial traits CO2. Recognize the parameters to assess opportunities and constraints for new business ideas CO3. Apply the systematic practice to select and screen a business idea CO4. Design strategies for successful implementation of ideas CO5. Design a business plan