Department of Electrical and Electronics Engineering

Program: B.Tech- Electrical and Electronics Engineering

Regulation: R16 **Course Outcomes** **No. of Courses: 70**

I-I Sem	Course:English-1
CO-1	Able to Using English languages, both written and spoken, competently and correctly
CO-2	Able to Improving comprehension and fluency of speech.
CO-3	Able to Gaining confidence in using English in verbal situations.
CO-4.	Able to employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information
CO-5	Able to recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs
CO-6	Able to form sentences using proper grammatical structures and correct word forms
I-I Sem	**Course:Mathematics-I**
CO-1	Able to Solve linear differential equations of first, second and higher order
CO-2	Able to Determine Laplace transform and inverse Laplace transform of various functions and use Laplace transforms to determine general solution to linear ODE.
CO-3	Able to Calculate total derivative, Jocobian and minima of functions of two variables.
CO-4.	Able to familiarize with functions of several variables which is useful in optimization
CO-5	Able to Apply double integration techniques in evaluating areas bounded by region
CO-6	Able to students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional and 3-dimensional coordinate systems
I-I Sem	**Course:Applied Chemistry**
CO-1	The advantages and limitations of plastic materials and their use in design would be understood.
CO-2	Fuels which are used commonly and their economics, advantages and limitations are discussed
CO-3	Reasons for corrosion and some methods of corrosion control would be understood.
CO-4	The students would be now aware of materials like nano-materials and fullerenes and their uses.
CO-5	Similarly liquid crystals and superconductors are understood. The importance of green synthesis is well understood and how they are different from conventional methods is also explained

CO-6	Conductance phenomenon is better understood. The students are exposed to some of the alternative fuels and their advantages and limitations.
I-I Sem	**Course:Computer Programming**
CO-1	Understand the basic terminology used in computer programming
CO-2	Write, compile and debug programs in C language.
CO-3	Use different data types in a computer program.
CO-4	Design programs involving decision structures, loops and functions.
CO-5	Explain the difference between call by value and call by reference
CO-6	Understand the dynamics of memory by the use of pointers
I-I Sem	**Course:Environmental Studies**
CO-1	The natural resources and their importance for the sustenance of the life and recognize the need to conserve the natural resources
CO-2	The concepts of the ecosystem and its function in the environment. The need forprotecting the producers and consumers in various ecosystems and their role in thefood web
CO-3	The biodiversity of India and the threats to biodiversity, and conservation practices toprotect the biodiversity
CO-4	Various attributes of the pollution and their impacts and measures to reduce or control the pollution along with waste management practices
CO-5	Social issues both rural and urban environment and the possible means to combat the challenges
CO-6	The environmental legislations of India and the first global initiatives towards sustainable development
I-I Sem	**Course:Applied/Engineering Chemistry Laboratory**
CO-1	The students entering into the professional course have practically very little exposure to lab classes.
CO-2	The experiments introduce volumetric analysis; redox titrations with different indicators; EDTA titrations; then they are exposed to a few instrumental methods of chemical analysis.
CO-3	Thus at the end of the lab course, the student is exposed to different methods of chemical analysis and use of some commonly employed instruments
I-I Sem	**Course: English - Communication Skills Lab- I**

CO-1	A study of the communicative items in the laboratory will help the students become successful in the competitive world.
CO-2	The course content along with the study material is divided into six units.
CO-3	Classify the roles of collaboration, risk-taking, multi-disciplinary awareness, and the imagination in achieving creative responses to problems
I-I Sem	**Course: Computer Programming Lab**
CO-1	Apply and practice logical ability to solve the problems.
CO-2	Understand C programming development environment, compiling, debugging, and linkingand executing a program using the development environment
CO-3	Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs
I-II Sem	**Course: English -II**
CO-1	The lesson underscores that the ultimate aim of Education is to enhance wisdom.
CO-2	Abdul Kalam's simple life and service to the nation inspires the readers to follow in his footsteps.
CO-3	The lesson enables the students to promote peaceful co-existence and universal harmony among people and society.
CO-4	The Achievements of C V Raman are inspiring and exemplary to the readers and all scientists
CO-5	The seminal contributions of Homi Jehangir Bhabha to Indian nuclear programme provide an aspiration to the readers to serve the nation and sterngthen it.
CO-6	The theme projects society's need to re examine its traditions when they are outdated
I-II Sem	**Course: Mathematics-II (Mathematical Methods)**
CO-1	Able to Calculate a root of algebraic and transcendental equations. Explain relation Between the finite difference operators.
CO-2	Able to Compute interpolating polynomial for the given data.
CO-3	Able to Solve ordinary differential equations numerically using Euler's and RK method.
CO-4	Able to Find Fourier series and Fourier transforms for certain functions.
CO-5	Able to Identify/classify and solve the different types of partial differential equations.
CO-6	Able to apply different algorithms for approximating the solutions of ordinary differential equations to its analytical computations
I-II Sem	**Course: Mathematics-III**
CO-1	Determine rank, Eigenvalues and Eigen vectors of a given matrix and solve simultaneous linear equations.

CO-2	Solve simultaneous linear equations numerically using various matrix methods.
CO-3	Determine double integral over a region and triple integral over a volume.
CO-4	Calculate gradient of a scalar function, divergence and curl of a vector function. Determine line, surface and volume integrals. Apply Green, Stokes and Gauss divergence theorems to calculate line, surface and volume integrals.
CO-5	able to know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms
CO-6	able to identify solution methods for partial differential equations that model physical processes
I-II Sem	**Course: Applied Physics**
CO-1	able to Construction and working details of instruments, ie., Interferometer, Diffractometer and Polarimeter are learnt.
CO-2	able to Study EM-fields and semiconductors under th concepts of Quantum mechanics paves way for their optimal utility
CO-3	able to the fundamental concepts of quantum mechanics.
CO-4	able to the various electron theories.
CO-5	able to the energy bands of semiconductors.
CO-6	able to the concept of polarization in dielectric materials.
I-II Sem	**Course: Electrical Circuit Analysis – I**
CO-1	Various electrical networks in presence of active and passive elements
CO-2	Electrical networks with network topology concepts.
CO-3	Any magnetic circuit with various dot conventions
CO-4	Any R, L, C network with sinusoidal excitation
CO-5	Any R, L, network with variation of any one of the parameters R, L, C. and f.
CO-6	Electrical networks by using principles of network theorems.
I-II Sem	**Course: English Language Communication Skills Lab- II**
CO-1	A study of the communicative items in the laboratory will help the students become successful in the competitive world.
CO-2	The course content along with the study material is divided into six units.
CO-3	Generalize appropriate concepts and methods from a variety ofdisciplines to solve problems effectively and creatively

I-II Sem	Course: Applied/Engineering Physics Lab
CO-1	Physics lab curriculum gives fundamental understanding of design of an Instrument with targeted accuracy for physical measurements.
CO-2	Understand principle, concept, working and application of new technology and comparison of results with theoretical calculations.
CO-3	Develop skills to impart practical knowledge in real time solution.
I-II Sem	**Course: Applied/Engineering Physics - Virtual Labs – Assignments**
CO-1	Physics Virtual laboratory curriculum in the form of assignment ensures an engineering graduate to prepare a /technical/mini-project/ experimental report with scientific temper.
CO-2	Design new instruments with practical knowledge.
CO-3	Gain knowledge of new concept in the solution of practical oriented problems and to understand more deep knowledge about the solution to theoretical problems.
II-I Sem	**Course: Electrical Circuit Analysis-II**
CO-1	Students are able to solve three- phase circuits under balanced and unbalanced condition
CO-2	Students are able find the transient response of electrical networks for different types of excitations.
CO-3	Students are able to find parameters for different types of network.
CO-4	Students are able to realize electrical equivalent network for a given network transfer function.
CO-5	Students are able to extract different harmonics components from the response of a electrical network.
CO-6	able to realize electrical equivalent network for a given network transfer function.
II-I Sem	**Course: Electrical Machines – I**
CO-1	Able to assimilate the concepts of electromechanical energy conversion
CO-2	Able to mitigate the ill-effects of armature reaction and improve commutation in dc machines.
CO-3	Able to understand the torque production mechanism and control the speed of dc motors.
CO-4	Able to analyze the performance of single phase transformers.
CO-5	Able to predetermine regulation, losses and efficiency of single phase transformers
CO-6	Able to parallel transformers, control voltages with tap changing methods and achieve three-phase to two-phase transformation

II-I Sem	Course: Basic Electronics And Devices
CO-1	Students are able to understand the basic concepts of semiconductor physics, which are useful to understand the operation of diodes and transistors.
CO-2	Students are able to explain the operation and characteristics of PN junction diode and special diodes.
CO-3	Ability to understand operation and design aspects of rectifiers and regulators
CO-4	Students are able to understand the characteristics of various transistor configurations. They become familiar with different biasing, stabilization and compensation techniques used in transistor circuits.
CO-5	Students are able to understand the operation and characteristics of FET, Thyristors, Power IGBTs and Power MOSFETs.
CO-6	Students are able to understand the merits and demerits of positive and negative feedback and the role of feedback in oscillators and amplifiers.
II-I Sem	**Course: Electromagnetic Fields**
CO-1	To Determine electric fields and potentialsusing guass's lawor solving Laplace's or Possion's equations, for various electric charge distributions.
CO-2	To Calculate and design capacitance, energy stored in dielectrics.
CO-3	To Calculate the magnetic field intensity due to current, the application of ampere's law and the Maxwell's second and third equations.
CO-4	To determine the magnetic forces and torque produced by currents in magnetic field
CO-5	To determine self and mutual inductances and the energy stored in the magnetic field.
CO-6	To calculate induced e.m.f., understand the concepts of displacement current and Poynting vector.
II-I Sem	**Course: Managerial Economics And Financial Analysis**
CO-1	The Learner is equipped with the knowledge of estimating the Demand and demand elasticities for a product and the knowledge of understanding of the Input-Output-Cost relationships and estimation of the least cost combination of inputs.
CO-2	One is also ready to understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units.
CO-3	The Learner is able to prepare Financial Statements and the usage of various Accounting tools for Analysis and to evaluate various investment project proposals with the help of capital budgeting techniques for decision making.
CO-4	The Learner is able to prepare Financial Statements and the usage of various Accounting tools for Analysis
CO-5	The Learner can able to evaluate various investment project proposals with the help of capital budgeting techniques for decision making.

CO-6	The pupil is also ready to understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units.
II-I Sem	**Course: Electrical Circuits Lab**
CO-1	Able to apply various thermos, determination of self and mutual inductances, two port parameters of a given electric circuits.
CO-2	Able to draw locus diagrams. Waveforms and phasor diagram for lagging and leading networks.
CO-3	**Apply mathematics, science, and engineering to the analysis and design of electrical circuits.**
II-II Sem	**Course: Electrical Measurements**
CO-1	Able to choose right type of instrument for measurement of voltage and current for ac and dc.
CO-2	Able to choose right type of instrument for measurement of power and energy – able to calibrate energy meter by suitable method
CO-3	Able to calibrate ammeter and potentiometer
CO-4	Able to select suitable bridge for measurement of electrical parameters
CO-5	Able to use the ballistic galvanometer and flux meter for magnetic measuring instruments
CO-6	Able to measure frequency and phase difference between signals using CRO. Able to use digital instruments in electrical measurements.
II-II Sem	**Course: Electrical Machines – II**
CO-1	Able to explain the operation and performance of three phase induction motor.
CO-2	Able to analyze the torque-speed relation, performance of induction motor and induction generator.
CO-3	Able to explain design procedure for transformers and three phase induction motors
CO-4	Implement the starting of single phase induction motors.
CO-5	To perform winding design and predetermine the regulation of synchronous generators.
CO-6	Avoid hunting phenomenon, implement methods of staring and correction of power factor with synchronous motor
II-II Sem	**Course: Control Systems**
CO-1	Ability to derive the transfer function of physical systems and determination of overall transfer function using block diagram algebra and signal flow graphs.
CO-2	Capability to determine time response specifications of second order systems and to determine error constants.

CO-3	Acquires the skill to analyze absolute and relative stability of LTI systems using Routh's stability criterion and the root locus method.
CO-4	Capable to analyze the stability of LTI systems using frequency response methods
CO-5	Able to design Lag, Lead, Lag-Lead compensators to improve system performance from Bode diagrams.
CO-6	Ability to represent physical systems as state models and determine the response. Understanding the concepts of controllability and observability.
II-II Sem	**Course: Power Systems-I**
CO-1	Students are able to identify the different components of thermal power plants.
CO-2	Students are able to identify the different components of nuclear Power plants.
CO-3	Students are able to distinguish between AC/DC distribution systems and also estimate voltage drops of distribution systems.
CO-4	Students are able to identifythe different components of air and gas insulated substations.
CO-5	Students are able to identifysingle core and multi core cables with different insulating materials
CO-6	Students are able to analyzethe different economic factors of power generation and tariffs.
II-II Sem	**Course: Management Science**
CO-1	After completion of the Course the student will acquire the knowledge on management functions, global leadership and organizational behavior.
CO-2	Will familiarize with the concepts of functional management project management and strategic management.
CO-3	Defines the basic concepts in the field of management.
CO-4	Discusses organizational theories and models which are the important infrastructures of the management field.
CO-5	Explains postmodern current concepts and approaches.
CO-6	Categorizes the approaches related to the environmental adaptation and change in the businesses.
II-II Sem	**Course: Electrical MachineS – I Laboratory**
CO-1	To determine and predetermine the performance of DC machines and Transformers
CO-2	To control the speed of DC motor.
CO-3	To achieve three phase to two phase transformation.
III-I Sem	**Course: Power Systems–II**

CO-1	Able to understand parameters of various types of transmission lines during different operating conditions.
CO-2	Able to understand the performance of short and medium transmission lines.
CO-3	Student will be able to understand travelling waves on transmission lines.
CO-4	Will be able to understand various factors related to charged transmission lines.
CO-5	Will be able to understand sag/tension of transmission lines and performance of line insulators.
CO-6	Recognize the need to continuously follow the advancements in technology and incorporating them in the present system to improve efficiency
III-I Sem	**Course: Renewable Energy Sources**
CO-1	Analyze solar radiation data, extraterrestrial radiation, and radiation on earth's surface.
CO-2	Design solar thermal collectors, solar thermal plants
CO-3	Design solar photo voltaic systems.
CO-4	Develop maximum power point techniques in solar PV and wind energy systems.
CO-5	Explain wind energy conversion systems, wind generators, power generation
CO-6	Explain basic principle and working of hydro, tidal, biomass, fuel cell and geothermal systems.
III-I Sem	**Course: Signals & Systems**
CO-1	Characterize the signals and systems and principles of vector spaces, Concept of orthgonality.
CO-2	Analyze the continuous-time signals and continuous-time systems using Fourier series, Fourier transform and Laplace transform.
CO-3	Apply sampling theorem to convert continuous-time signals to discrete-time signal and reconstruct back
CO-4	Understand the relationships among the various representations of LTI systems
CO-5	Understand the Concepts of convolution, correlation, Energy and Power density spectrum and their relationships.
CO-6	Apply z-transform to analyze discrete-time signals and systems.
III-I Sem	**Course: Pulse And Digital Circuits Objectives**
CO-1	Design linear and non-linear wave shaping circuits.
CO-2	Apply the fundamental concepts of wave shaping for various switching and signal generating circuits
CO-3	Design different multivibrators and time base generators.

CO-4	Utilize the non sinusoidal signals in many experimental research areas.
CO-5	Understand the response of high pass RC and low pass RC circuits to different non sinusoidal inputs with different time constants and identify RC circuit's applications.
CO-6	Understand the various clipper circuits using switching components like diodes, transistors and design various clipper circuits with and without reference voltages
III-I Sem	**Course: Power Electronics**
CO-1	Explain the characteristics of various power semiconductor devices and analyze the static and dynamic characteristics of SCR's.
CO-2	Design firing circuits for SCR.
CO-3	Explain the operation of single phase full–wave converters and analyze harmonics in the input current.
CO-4	Explain the operation of three phase full–wave converters.
CO-5	Analyze the operation of different types of DC-DC converters
CO-6	Explain the operation of inverters and application of PWM techniques for voltage control and harmonic mitigation.
III-I Sem	**Course: Electrical Machines – II Laboratory**
CO-1	Able to assess the performance ofsingle phase and three phase induction motors.
CO-2	Able to control the speed of three phase induction motor
CO-3	Able to predetermine the regulation of three–phase alternator by various methods
III-I Sem	**Course: Control Systems Lab**
CO-1	Able to analyze the performance and working Magnetic amplifier, D.C and A.C. servo motors and synchronous motors.
CO-2	Able to design P,PI,PD and PID controllers
CO-3	Able to design lag, lead and lag–lead compensators
III-I Sem	**Course: Electrical Measurements Laboratory**
CO-1	To be able to measure the electrical parameters voltage, current, power, energy and electrical characteristics of resistance, inductance and capacitance.
CO-2	To be able to test transformer oil for its effectiveness.
CO-3	To be able to measure the parameters of inductive coil
III-I Sem	**Course: Intellectual Property Rights And Patents**

CO-1	IPR Laws and patents pave the way for innovative ideas which are instrumental for inventions to seek Patents.
CO-2	Student get an insight on Copyrights, Patents and Software patents which are instrumental for further advancements.
CO-3	Distinguish and Explain various forms of IPRs.
CO-4	Identify criteria's to fit one's own intellectual work in particular form of IPRs
CO-5	Apply statutory provisions to protect particular form of IPRs.
CO-6	Analyse rights and responsibilities of holder of Patent, Copyright, Trademark, Industrial Designetc
III-II Sem	**Course: Power Electronic Controllers & Drives**
CO-1	Explain the fundamentals of electric drive and different electric braking methods.
CO-2	Analyze the operation of three phase converter fed dc motors and four quadrant operations of dc motors using dual converters.
CO-3	Describe the converter control of dc motors in various quadrants of operation
CO-4	Know the concept of speed control of induction motor by using AC voltage controllers and voltage source inverters
CO-5	Differentiate the stator side control and rotor side control of three phase induction motor..
CO-6	Explain the speed control mechanism of synchronous motors
III-II Sem	**Course: Power System Analysis**
CO-1	Able to draw impedance diagram for a power system network and to understand per unit quantities.
CO-2	Able to form aYbusand Zbusfor a power system networks.
CO-3	Able to understand the load flow solution of a power system using different methods
CO-4	Able to find the fault currents for all types faults to provide data for the design of protective devices.
CO-5	Able to findthe sequence components of currents for unbalanced power system network.
CO-6	Able to analyze the steady state, transient and dynamic stability concepts of a power system.
III-II Sem	**Course:Microprocessors And Microcontrollers**
CO-1	To be able to understand the microprocessor capability in general and explore the evaluation of microprocessors.
CO-2	To be able to understand the addressing modes of microprocessors
CO-3	To be able to understand the micro controller capability

CO-4	To be able to program mp and mc
CO-5	To be able to interface mp and mc with other electronic devices
CO-6	To be able to develop cyber physical systems
III-II Sem	**Course:Data Structures Through C++**
CO-1	Distinguish between procedures and object oriented programming.
CO-2	Apply advanced data structure strategies for exploring complex data structures
CO-3	Compare and contrast various data structures and design techniques in the area of Performance.
CO-4	Implement data structure algorithms through C++. • Incorporate data structures into the applications such as binary search trees, AVL and B Trees
CO-5	Implement all data structures like stacks, queues, trees, lists and graphs and compare their Performance and trade offs
CO-6	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data
III-II Sem	**Course: Unix And Shell Programming Open elective**
CO-1	Documentation will demonstrate good organization and readability
CO-2	File processing projects will require data organization, problem solving and research
CO-3	Scripts and programs will demonstrate simple effective user interfaces
CO-4	Scripts and programs will demonstrate effective use of structured programming
CO-5	Scripts and programs will be accompanied by printed output demonstrating completion of a test plan.
CO-6	Testing will demonstrate both black and glass box testing strategies
III-II Sem	**Course: OOPs through Java**
CO-1	Explain what constitutes an object-oriented approach to programming and identify potentialbenefits of object-oriented programming over other approaches
CO-2	Apply an object-oriented approach to developing applications of varying complexities
CO-3	Understand the properties of MOS active devices and simple circuits configured when using them and the reason for such encumbrances as ratio rules by which circuits can be interconnected in silicon.
CO-4	Know three sets of design rules with which nMOS and CMOS designs may be fabricated.
CO-5	Understand the scaling factors determining the characteristics and performance of MOS circuits in silicon.
CO-6	Understand generic programming, templates, file handling

III-II Sem	**Course: Robotics (Open Elective)**
CO-1	The Student must be able to design automatic manufacturing cells with robotic control using
CO-2	The principle behind robotic drive system, end effectors, sensor, machine vision robot Kinematics and programming.
CO-3	Demonstrate knowledge of industrial robots, characteristics, end effectors and actuators
CO-4	Apply spatial transformation to obtain forward and inverse kinematics
CO-5	Solve robot dynamics problems, generate joint trajectory for path planning
CO-6	Describe working principle of various sensors and program different operations
III-II Sem	**Course: Neural Networks And Fuzzy Logic (Open Elective)**
CO-1	Know different models of artificial neuron
CO-2	Use learning methods of ANN.
CO-3	Use different paradigms of ANN.
CO-4	Classify between classical and fuzzy sets.
CO-5	Use different modules of Fuzzy logic controller.
CO-6	Apply Neural Networks and fuzzy logic for real-time applications.
III-II Sem	**Course: Energy Audit, Conservation & Management (Open Elective)**
CO-1	Explain energy efficiency, conservation and various technologies
CO-2	Design energy efficient lighting systems
CO-3	Calculate power factor of systems and propose suitable compensation techniques
CO-4	Explain energy conservation in HVAC systems.
CO-5	Calculate life cycle costing analysis and return on investment on energy efficient technologies.
CO-6	Students will be able to guide the employees of the organization about the need and the methods of energy conservation.
III-II Sem	**Course: Power Electronics Lab**
CO-1	Able to study the characteristics of various power electronic devices and analyze gate drive circuits of IGBT.
CO-2	Able to analyze the performance of single–phase and three–phase full–wave bridge converters with both resistive and inductive loads. and inductive loads..

CO-3	Able to understand the operation of single phase AC voltage regulator with resistive
III-II Sem	**Course: Micro Mprocessors And Micro Controllers Lab**
CO-1	Will be able to write assembly language program using 8086 micro based on arithmetic, logical, and shift operations
CO-2	Will be able to interface 8086 with I/O and other devices
CO-3	Will be able to do parallel and serial communication using 8051 & PIC 18 micro controllers
III-II Sem	**Course: Datastructures Through C Lab**
CO-1	Be able to design and analyze the time and space efficiency of the data structure
CO-2	Be capable to identity the appropriate data structure for given problem
CO-3	Have practical knowledge on the application of data structures
III-II Sem	**Course: Professional Ethicsand Human Values**
CO-1	It gives a comprehensive understanding of a variety issues that are encountered by every professional in discharging professional duties.
CO-2	It provides the student the sensitivity and global outlook in the contemporary world to fulfill the professional obligations effectively
CO-3	Articulate what makes a particular course of action ethically defensible
CO-4	Assess their own ethical values and the social context of problems
CO-5	Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data, and the treatment of human
CO-6	Demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work integrate, synthesize, and apply knowledge of ethical dilemmas and resolutions in academic settings, including focused and interdisciplinary research
IV-I Sem	**Course: Utilization Of Electrical Energy**
CO-1	Able to identify a suitable motor for electric drives and industrial applications
CO-2	Able to identify most appropriate heating or welding techniques for suitable applications
CO-3	Able to understand various level of illuminosity produced by different illuminating sources.
CO-4	Able to estimate the illumination levels produced by various sources and recommend the most efficient illuminating sources and should be able to design different lighting systems by taking inputs and constraints in view.

CO-5	Able to determine the speed/time characteristics of different types of traction motors.
CO-6	Able to estimate energy consumption levels at various modes of operation
IV-I Sem	**Course: Linear IC Applications**
CO-1	Design circuits using operational amplifiers for various applications.
CO-2	Analyze and design amplifiers and active filters using Op-amp.
CO-3	Diagnose and trouble-shoot linear electronic circuits
CO-4	Understand thc gain-bandwidth concept and frequency response of the amplifier configurations.
CO-5	Understand thoroughly the operational amplifiers with linear integrated circuits
CO-6	Comprehend & differentiate the working principle of various data converters.
IV-I Sem	**Course: Power System Operation And Control**
CO-1	Able to compute optimal scheduling of Generators.
CO-2	□Able to understand hydrothermal scheduling
CO-3	Understand the unit commitment problem.
CO-4	Able to understand importance of the frequency.
CO-5	Understand importance of PID controllers in single area and two area systems
CO-6	Will understand reactive power control and compensation for transmission line
IV-I Sem	**Course: Switchgear And Protection**
CO-1	Able to understand the principles of arc interruption for application to high voltage circuit breakers of air, oil, vacuum, SF6 gas type.
CO-2	Ability to understand the working principle and operation of different types of electromagnetic protective relays.
CO-3	Students acquire knowledge of faults and protective schemes for high power generator and transformers.
CO-4	Improves the ability to understand various types of protective schemes used for feeders and bus bar protection for insulation co–ordination.
CO-5	Able to understand different types of static relays and their applications
CO-6	Able to understand different types of over voltages and protective schemes required
IV-I Sem	**Course: Electrical Machine Modeling & Analysis (Elective-I)**
CO-1	Develop modeling of dc machine

CO-2	Apply mathematical modeling concepts to 3-phase Induction machines
CO-3	Design control strategies based on dynamic modeling of 3-ph Induction machines and 3-phase synchronous machine
CO-4	Analyze BLDC Machine and switched reluctance machine based on mathematical modeling of BLDCM and SRM.
CO-5	Model any electrical machine given its parameters
CO-6	Perform the steady state & transient analysis of electrical machines.
IV-I Sem	**Course: Advanced Control Systems**
CO-1	State space representation of control system and formulation of different state models are reviewed..
CO-2	Able to design of control system using the pole placement technique is given after introducing the concept of controllability and observability.
CO-3	Able to analyse of nonlinear system using the describing function technique and phase plane analysis.
CO-4	Able to analysethe stability analysis using lypnov method.
CO-5	Minimization of functionals using calculus of variation studied.
CO-6	Able to formulate andsolve the LQR problem and riccatti equation
IV-I Sem	**Course: Progammable Logic Controllers & Applications**
CO-1	After completion of the course, students are able to
CO-2	Understand the PLCs and their I/O modules
CO-3	Develop control algorithms to PLC using ladder logic.
CO-4	Manage PLC registers for effective utilization in different applications.
CO-5	Design PID controller with PLC.
CO-6	Students will be able to design and program basic PLC circuits for entry-level PLC applications.
IV-I Sem	**Course: Instrumentation (Elective – I)**
CO-1	Able to represent various types of signals .
CO-2	Acquire proper knowledge to use various types of Transducers.
CO-3	Able to monitor and measure various parameters such as strain, velocity, temperature, pressure etc.
CO-4	Acquire proper knowledge and working principle of various types of digital voltmeters.

CO-5	Able to measure various parameter like phase and frequency of a signal with the help of CRO.
CO-6	Acquire proper knowledge and able to handle various types of signal analyzers
IV-I Sem	**Course: Optimization Techniques (Elective – II)**
CO-1	State and formulate the optimization problem, without and with constraints, by using design variables from an engineering design problem
CO-2	Apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints, and arrive at an optimal solution.
CO-3	Formulate a mathematical model and apply linear programming technique by using Simplex method. Also extend the concept of dual Simplex method for optimal solutions.
CO-4	Apply gradient and non-gradient methods to nonlinear optimization problems and use nterior or exterior penalty functions for the constraints to derive the optimal solutions.
CO-5	Able to apply Genetic algorithms for simple electrical problems
CO-6	Able to solve practical problems using PSO.
IV-I Sem	**Course: Electric Power Quality**
CO-1	Differentiate between different types of power quality problems.
CO-2	Explain the sources of voltage sag, voltage swell, interruptions, transients, long duration over voltages and harmonics in a power system.
CO-3	Analyze power quality terms and power quality standards.
CO-4	Explain the principle of voltage regulation and power factor improvement methods.
CO-5	Demonstrate the relationship between distributed generation and power quality.
CO-6	Explain the power quality monitoring concepts and the usage of measuring instruments.
IV-I Sem	**Course: Special Electrical Machines**
CO-1	Distinguish between brush dc motor and brush less dc motor
CO-2	Explain the performance and control of stepper motors, and their applications.
CO-3	Explain theory of operation and control of switched reluctance motor.
CO-4	Explain the theory of travelling magnetic field and applications of linear motors.
CO-5	Understand the significance of electrical motors for traction drives.
CO-6	explain the theory of travelling magnetic field and applications of linear motors. understand the significance of electrical motors for traction drives

IV-I Sem	Course: Electrical Simulation Lab
CO-1	Able to simulate integrator circuit, differentiator circuit, Boost converter, Buck converter, full convertor and PWM inverter.
CO-2	Able to simulate transmission line by incorporating line, load and transformer models
CO-3	Able to perform transient analysis of RLC circuit and single machine connected to infinite bus(SMIB).
IV-I Sem	**Course: Power Systems Lab**
CO-1	The student is able to determine the parameters of various power system components which are frequently occur in power system studies and he can execute energy management systems functions at load dispatch center.
CO-2	Analyze the performance of transmission lines and relays
CO-3	Calculate the steady-state power flow in a power system.
IV-II Sem	**Course: Digital Control Systems**
CO-1	The students learn the advantages of discrete time control systems and the "know how" of various associated accessories.
CO-2	The learner understand z–transformations and their role in the mathematical analysis of different systems(like Laplace transforms in analog systems).
CO-3	The stability criterion for digital systems and methods adopted for testing the same are explained.
CO-4	Finally, the conventional and state space methods of design are also introduced.
CO-5	ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
CO-6	ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
IV-II Sem	**Course: H.V.D.C. Transmission**
CO-1	Learn different types of HVDC levels and basic concepts
CO-2	Know the operation of converters
CO-3	Acquire control concept of reactive power control and AC/DC load flow.
CO-4	Understand converter faults, protection and harmonic effects
CO-5	Design low pass and high pass filters
CO-6	Review the existing HVDC systems along with MTDC systems and their controls and recognize the need to follow the advancements in both the existing systems and HVDC systems.

IV-II Sem	**Course: Electrical Distribution Systems**
CO-1	Able to understand various factors of distribution system
CO-2	Able to design the substation and feeders.
CO-3	Able to determine the voltage drop and power loss
CO-4	Able to understand the protection and its coordination
CO-5	Able to understand the effect of compensation forp.f improvement
CO-6	Able to understand the effect of voltage control.
IV-II Sem	**Course: High Voltage Engineering (Elective – III)**
CO-1	To be acquainted with the performance of high voltages with regard to different configurations of electrode systems.
CO-2	To be able to understand theory of breakdown and withstand phenomena of all types of dielectric materials.
CO-3	To acquaint with the techniques of generation of AC,DC and Impulse voltages.
CO-4	To be able to apply knowledge for measurement of high voltage and high current AC,DC and Impulse
CO-5	To be in a position to measure dielectric property of material used for HV equipment
CO-6	To know the techniques of testing various equipment's used in HV engineering.
IV-II Sem	**Course: Flexible Alternating Current Transmission Systems**
CO-1	Understandpower flow control in transmission lines using FACTS controllers
CO-2	Explain operation and control of voltage source converter.
CO-3	Analyze compensation methods to improve stability and reduce power oscillations in the transmission lines
CO-4	Explain the method of shunt compensation using static VAR compensators
CO-5	Understand the methods of compensations using series compensators
CO-6	Explain operation of Unified Power Flow Controller (UPFC).
IV-II Sem	**Course: Power System Reforms (Elective III)**
CO-1	Will understand importance of power system deregulation and restructuring
CO-2	Able to compute Available Transfer Capability.
CO-3	Will understand transmission congestion management

CO-4	Able to compute electricity pricing in deregulated environment.
CO-5	Will be able to understand power system operation in deregulated environment.
CO-6	Will be able to understand power system operation in deregulated environment.
IV Sem -II	**Course: Project**
CO-1	Formulate., and apply mathematical, science and engineering principles to solve real time engineering problems
CO-2	Test the existing data, communicate and conduct research on complex problems using modern tools
CO-3	Validate the obtained results on contemprory issues related to society and environment
CO-4	Determine effectively the engineering principles used intheir project individually and as a team as per the norms of engineering practice
CO-5	Structure future work to promote life long learning in the context of technological adaptation.

Principal
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