Course Name: **Electrical circuits -I**

	Course Outcomes
CO1	Analyze the concept of electrical circuits and magnetic circuits and study different techniques to calculate voltage and current.
CO2	Determining the response of circuits to single phase A.C excitation and evaluate the RMS value and Average Values
CO3	Depict the locus diagrams of various combinations of circuits along with the analysis of concept of resonance
CO4	Understand the concept of bandwidth and Q factor in various series and parallel circuits.
CO5	Interpret the technique of solving circuits employing theorems which involve Norton's, Thevenin's, Maximum Power transfer theorem etc.
CO6	Analyze the concept of two port parameters with respect to impedance, admittance, Transmission and Hybrid parameters

Course Name: **MATHEMATICS-I (R15 & R18)**

	Course Outcomes
CO1	Apply the mathematical principles to solve first and second order differential equations
CO2	Analyze the non homogeneous linear differential equations of second and higher order along with Euler – Cauchy's equations and Legendre's linear equation
CO3	Apply the differential equations of second and higher order in various streams ---like Electrical Circuits,Simple Harmonic motion,Deflection of beams
CO4	Estimate the Taylors and Maclaurin series involving Maxima and minima of functions consisting of 2 variables along with radius of curvature
CO5	Evaluate the multiple integrals involving double and triple integrals along with change of order of integration and apply the multiple integrals to areas and volumes in polar and Cartesian coordinates.
CO6	Analyze the concept of vector calculus involving divergence, curl, green's theorm, Stoke's and Gauss theorms

Course Name: **MATHEMATICS-II (R15 & R18)**

	Course Outcomes
CO1	Analyze the concept of Laplace transform of standard functions along with inverse transform, dirac's delta function and convolution theorem
CO2	Apply the Laplace transforms to ordinary differential equations of first order and second order
CO3	Carry out the determination of Fourier coefficients in terms of Fourier series involving Half range Fourier sine and cosine expansions
CO4	Interpret the Fourier integral theorem along with Fourier sine and cosine transformation and also the concept of inverse transformation
CO5	Formulate the partial differential equations through elimination of arbitrary constants and also understand the technique of separation of variables
CO6	Analyze the technique of Z-transformation for various conditions along with analysis of Fourier transforms

Course Name: **NETWORK ANALYSIS LAB**

	Course Outcomes
CO1	Solve the electrical network using mesh and nodal analysis by applying network theorems
CO2	Estimate the impedance for maximum power transfer and will be in a position to design the systems for maximum power transformation.
CO3	Analyze the transient response of series and parallel A.C. circuits and to solve problems in time domain using Laplace Transform.
CO4	Communicate clearly and use the appropriate medium, including written, oral, and electronic methods.
CO5	Analyze and design a filter to meet its specifications using PSPICE Software
CO6	Engage in independent and lifelong learning in the context of technological changes.

Course Name: **NETWORK ANALYSIS**

	Course Outcomes
CO1	Analyze the concept of electrical circuits and magnetic circuits and study different techniques to calculate voltage and current and also Interpret the technique of solving circuits employing various theorems
CO2	Perform the D.C and A.C transient analysis on combination of circuits along with source transformation
CO3	understand and analyze the fundamental concept of single phase circuits and also determine different powers for a given circuit

CO4	Depict the locus diagrams of various combinations of circuits along with the analysis of concept of resonance
CO5	understand and analyze the concept of two port parameters and apply it for different two port networks
CO6	Understand the concept of filters and able to design different filters

Course Name: **CONTROL SYSTEM ENGINEERING**

CO1	Understand the concepts of feedback control systems, analogies between electrical and mechanical systems.
CO2	Find the transfer function, time domain specifications and steady state errors.
CO3	Apply R-H criterion and root locus concepts to determine the stability of the given system.
CO4	Find the frequency domain specifications of second order systems and determine the stability of the systems using Bode plot and Nyquist plot techniques.
CO5	Determine the transfer function and gain & phase margins from the Bode plot & Nyquist plot.
CO6	Develop state model of a given system, solve the state equations and test the observability and controllability of the given system.

Course Name: **CONTROL SYSTEMS AND SIMULATION LAB**

	Course Outcomes
CO1	Determine experimentally the time domain reposes of a given second order system
CO2	Analyze the effect of P,PI,PID controller on the step response of a feedback control system
CO3	Design & conduct experiment on Lead, Lag & Lag & Lead Compensators for the given specifications.
CO4	Draw the characteristics of AC servo motor, DC servo motor and Magnetic amplifier
CO5	Apply the control systems concepts to synchro transmitter and synchro receiver pair
CO6	Design state space based controllers, compensators and systems using MATLAB software.

Course Name: **ELECTRCAL CIRCUITS – II**

	Course Outcomes
CO1	Carry out the transient analysis of RL,RC,RLC series circuits for DC & AC Excitations
CO2	Analyze three phase balanced and unbalanced circuits and determine line voltages,line currents, phase voltages and phase currents
CO3	Measure active and reactive power in three phase circuit

CO4	To understand the concept of graph Theory, nodal and mesh analysis
CO5	Apply Fourier transforms to various electrical circuits.
CO6	Design various types of filters.

Course Name: **ELECTRICAL CIRCUITS AND SIMULATION LAB**

	Course Outcomes
CO1	Explain electric circuit concepts by interpreting the simulation results.
CO2	Design RLC series circuit for specified frequency response.
CO3	Analyze three phase balanced and unbalanced circuits.
CO4	Design RL, RC and RLC circuits for specified transient response.
CO5	Design and Frequency Response of Low Pass and High Pass.
CO6	Explain electric circuit concepts by interpreting the simulation results.

Course Name: **ELECTRICAL MACHINES-I Lab**

	Course Outcomes
CO1	Evaluate the open circuit characteristics in order to find the critical resistance, speed and also list out the external and internal characteristics of dc shunt machines.
CO2	Perform the load test and brake test on DC shunt generator and motor in order to determine the performance characteristics.
CO3	Determine the efficiency of DC shunt and series machines through fields test and Hopkinson's test respectively.
CO4	Predetermine the efficiency of DC shunt motor by conducting Swinburne's test and also control the speed of dc motor by different method.
CO5	Draw the characteristics of DC series generator by conducting load test and also carry out the separation of losses in DC shunt motor
CO6	Analyze the performance curves of DC compound motor by conducting brake test on the motor

Course Name: **ELECTRICAL MACHINES-I**

	Course Outcomes
C206.1	Analyze the formulation of electromechanical energy conversion in single and multi excited systems.
C206.2	Describe the principle of Operation of Motor,Generator and classify the DC Machines into separately excited and self-excited
C206.3	Perform tests like swinburnes test and brake test in order to determine the losses and efficiency of DC Machines
C206.4	Understand the methods to control the speed of DC motor by various methods like armature control,field control and ward leonard method

C206.5	Interpret the construction and working of three point starter and four point starter in dc motor for limiting the starting current
C206.6	Interpret the concept of armature reaction and commutation in dc machine along with its corresponding improvement

Course Name: **ELECTRICAL MACHINES-II**

	Course Outcomes
CO1	Enumerate the working and construction of single phase transformer, along with determination of various tests in order to determine the performance and efficiency.
CO2	Identify the three phase transformers employed in distribution and transmission system based on their connections.
CO3	Investigate the operation and working principles of various types of induction motors and depict the torque speed characteristics
CO4	Perform various tests on three phase induction motor like Brake test, No-Load and Blocked Rotor tests in order to determine the performance and efficiency.
CO5	Conduct various tests like O.C, S.C and sumpners test on single phase transformer to determine the performance , losses and efficiency
CO6	Analyze the various starting methods of induction motors and also control methods for speed control of induction motor.

Course Name: **ELECTRICAL POWER GENERATING SYSTEMS**

	Course Outcomes
CO1	Recognize the importance and economic aspects of power generation and difference between renewable and non-renewable energy sources, recall the process of nuclear fission and chain reaction.
CO2	Analyze the construction, working and operating principle, and essential components of various power generating stations with their relative merits and demerits.
CO3	Design the layout and select the optimal location for different power plants along with its relevant features.
CO4	Analyze the different methods and characteristics of solar, wind, biogas, geothermal and ocean power generating systems along with their economic and environmental aspects.
CO5	Carry out a detailed analysis on the economic aspects of power generation involving various tariff methods and costs of generation.
CO6	Function effectively as a member or leader in a team in the development of Power System applications.

Course Name: **Electromagnetic Fields**

	Course Outcomes
CO1	Apply vector calculus to generalize the behavior of static electric fields in standard configurations.
CO2	Understand the behavior of static magnetic fields in standard configurations by applying vector calculus.
CO3	Analyze the inductance and capacitance for different structures.
CO4	Apply the force in electric field and magnetic field and both.
CO5	Examine the effect of time varying fields involving both electric and magnetic field on a wave propagating through a medium along analysis of with modified Maxwell's equations for time varying fields.
CO6	Use of modern tool MATLAB to simulate electromagnetic fields of transmission lines.

Course Name: **Managerial Economics and Financial Analysis**

	Course Outcomes
CO1	Understand, Concepts of economics, managerial economics, demand determinants, law of demand and its exceptions, types and measurement of elasticity of demand,demand forecasting.
CO2	Understand production function, isoquants and isocosts, MRTS, least cost combinationof inputs, Cobb-Douglas production function and law of return to scale. Types of cost,BEA, BEP..
CO3	Understand market structure, types of markets, price-output determination underperfect competition, monopoly, monopolistic competition and pricing methods,types of business organizations and LPG.
CO4	Understanding the concepts of accounting principles and apply them to know the financial position of a company.
CO5	Evaluate the financial position of the company by using Ratio Analysis.
CO6	Understand capital, types, sources, estimation of capital requirements, capital budgeting and techniques of capital budgeting.

Course Name: **MATHEMATICS-III (R15)**

	Course Outcomes
CO1	Demonstrate knowledge of matrix calculation as an elegant and powerful mathematical language in connection with rank of a matrix, linear system of equations, linear dependence and independence.

CO2	Interpret the Eigen values and Eigen vectors of matrix in terms of the transformation it represents in to a matrix Eigen value problem. Define a quadratic form and determine its nature using Eigen values.
CO3	Perform the solutions of algebraic and transcendental equation employing bisection method, false position method and Newton-Raphson method
CO4	Understand the technique of interpolation along with Lagrange's formula and Newton's interpolation formulae.
CO5	Understand and apply the concepts of curve fitting, numerical differentiation and integration.
CO6	Interpret the numerical solutions of ordinary differential equations employing Taylor series, Euler's, Picard's and Runga-kutta methods.

Course Name: **MATHEMATICS-IV (R15)**

	Course Outcomes
CO1	Apply Beta and Gamma functions to evaluate many integrals which cannot be expressed in terms of elementary functions.
CO2	Demonstrate the usage of Bessel functions and Legendre polynomials in solving various engineering problems.
CO3	Analyze the functions of complex variable which include continuity, differentiability and analyticity along with evaluation of Cauchy-Riemann equations in Cartesian and polar coordinates
CO4	Perform the Conformal mapping which includes bilinear transformation, translation, rotation, magnification and inversion.
CO5	Employ the Cauchy's integral theorem along with integral formula along with expansion in Taylor's series, Maclaurin's series and Laurent series along with radius of convergence.
CO6	Evaluate the residual formula through Laurent series and residue theorem along with evaluation of improper real integrals.

Course Name: **ELECTRICAL MACHINES-II Lab**

	Course Outcomes
CO1	Conduct suitable tests on single phase transformer and pre determine the efficiency and regulation at different loading conditions.
CO2	Perform the regulation of alternator by EMF and MMF methods in order to evaluate voltage regulation at different power factors and also determine the Xd and Xq values.
CO3	Carry out No load and blocked rotor tests on three phase induction motor to determine efficiency and also to draw the performance characteristics.
CO4	Analyze the equivalent circuit diagrams of single phase induction motor by conducting various tests.

CO5	Conduct the brake test on 3 phase induction motors and evaluate the performance characteristics
CO6	Convert 3 phase to 2 phase connection in 3 phase transformer through scott connection

Course Name: **ELECTRICAL MACHINES-III**

	Course Outcomes
C304.1	Understand the construction and principle of operation of round rotor and salient pole machines along with E.M.F Equation, different types of windings, alternator on load.
C304.2	Determine experimentally the characteristics of synchronous generator along with phasor diagram and also evaluate the regulation by synchronous impedance method, M.M.F method and Z.P.F method.
C304.3	Interpret the parallel operation of synchronous generators and determination of sub-transient, transient and steady state reactance's.
C304.4	Explain the principle of operation of synchronous motor along with V and Inverted V curves and also describe the concept of hunting and methods of starting in synchronous induction motor.
C304.5	Infer the constructional features of single phase motor along with double revolving field theory and elementary idea of cross-field theory.
C304.6	Carry out a detailed analysis on special motors which include A.C series motor, universal motor and reluctance motor.

Course Name: **ELECTRICAL MEASUREMENTS LABORATORY**

	Course Outcomes
CO1	Perform the calibration and testing of single-phase energy meter and dynamometer power factor meter.
CO2	Determine and formulate the parameters like resistance, inductance and capacitance using DC and AC bridges.
CO3	Calculate the three-phase reactive power in the given circuit through single phase wattmeter
CO4	Evaluate the three-phase real and reactive power in the given circuit through two single phase wattmeter.
CO5	Measure parameters of choke coil using three ammeters and three voltmeters method.
CO6	Analyze the calibration of LVDT, Strain gauge and DC Crompton Potentiometer and also depict their characteristics.

Course Name: **ELECTRICAL MEASUREMENTS**

	Course Outcomes
CO1	Calculate the various errors along with understanding the principle and operation of basic instruments employed for measuring purpose.
CO2	Interpret the working and operating principle of current transformer and Potential transformer along with the 1 phase and 3 phase power factor meters.
CO3	Categorizing the instruments employed for measurement of power and energy along with the analysis of A.C and D.C Potentiometers.
CO4	Determine the measurement of passive parameters (R,L,C) through various bridges along with their phasor representation
CO5	Explain the constructional details of ballistic galvanometer along with the B-H loop method of reversal.
CO6	Carry out detailed analysis on the working and application of cathode ray oscilloscope along with the analysis on the working of digital meters

Course Name: **ELECTRICAL POWER TRANSMISSION SYSTEMS**

	Course Outcomes
C302.1	Analyze the passive parameters (R,L,C) of a transmission line and to calculate the same for different configurations of transmission lines.
C302.2	Evaluate the performance of short, medium and long transmission lines along with surge impedance and surge impedance loading
C302.3	Investigate the effect of Corona on the transmission lines and various reduction techniques along with types of Insulators and methods to provide equipotential distribution across them to protect from high dielectric stress
C302.4	Estimate the mechanical design of transmission line involving Sag and tension calculations along with considering the effect of wind and ice.
C302.5	Carry out detailed study about the various transients in power systems along with Bewley's Lattice diagrams
C302.6	Interpret the insulation resistance , stress and capacitance of single core and three- core cable

Course Name: **POWER ELECTRONICS AND SIMULATION LABORATORY**

	Course Outcomes
CO1	Plot the output waveforms for the different gate firing circuits for SCR.
CO2	Analyze the output waveforms for different firing angles by conducting experiments on single phase AC voltage controller and Cycle converter with R and RL loads.
CO3	Analyze the output waveforms for different firing angles by conducting experiments on DC Jones Chopper andSingle Phase Dual Converter with R and RL loads.

CO4	Understand the operation of single phase series and parallel inverters with R and RL loads.
CO5	Design Illumination control / Fan control using TRIAC
CO6	Construct the output waveforms for Buck-Boost converter,Half bridge and Full bridge inverter circuit using MATLAB.

Course Name: **POWER SYSTEM ANALYSIS**

	Course Outcomes
CO1	Analyze the representation of various power system elements and formation of Y bus
CO2	Design the formation of Z bus in power system in various addition / removal of buses
CO3	Investigate power flow studies through the implementation of Gauss-siedel methods and Newton Raphson's method in rectangular and polar forms
CO4	Carry out the short circuit analysis involving symmetrical fault analysis and analyze the concept of symmetrical components involving positive, negative and zero sequence components
CO5	Investigate the steady state analysis in power systems under various operating conditions and also depict the power angle curve
CO6	Interpret the transient state analysis in power systems by Equal area criterion and also calculate the solution of swing equation through runga-kutta method

Course Name: **POWER SYSTEM PROTECTION**

	Course Outcomes
C404.1	Realize the basic requirements of relays as primary and backup protection along with their constructional details
C404.2	Analyze the static and microprocessor based relays along with their specifications, advantages and disadvantages
C404.3	Interpret the various techniques involves in the generator and transformer protection against faults in the system
C404.4	Explain the techniques involves in the protection of feeders and transmission lines
C404.5	Understand the fundamental principles of circuit breakers along with their ratings and specifications
C404.6	Describe the causes for over-voltages in power system and also explain the various protective schemes for the protection from over-voltages

Course Name: **PROGRAMMABLE LOGIC CONTROLLER AND ITS APPLICATIONS**

	Course Outcomes
CO1	Explain the basic concepts of Programmable Logic Controller, architecture and its connecting devices

CO2	Solve the given Logic gate diagram into PLC ladder diagram and vice versa
CO3	Design and Programme a PLC ladder structures for Industrial Applications.
CO4	Analyze the control circuits for various applications using Timers and Counters
CO5	Understand the concept of different data handling functions used in PLC
CO6	Apply the PLC simulation software on wide range of PLC applications

Course Name: **DIGITAL SIGNAL PROCESSING LAB**

	Course Outcomes
CO1	Compute the energy, power and convolution of discrete time sequences using MATLAB.
CO2	Compute the DTFT, N-Point DFT using FFT algorithm.
CO3	Design FIR filters using windowing techniques.
CO4	Design IIR filter and verify its frequency response.
CO5	Compare frequency response of FIR and IIR filters.
CO6	Find the frequency response of analog filters.

Course Name: **DIGITAL SIGNAL PROCESSING**

	Course Outcomes
CO1	Analyze various discrete time signals and systems.
CO2	Analyze the response of the discrete time systems in time and frequency domain.
CO3	Compute and analyze DFT using various algorithms.
CO4	Analyze various realization forms of FIR and IIR Filters.
CO5	Design digital FIR and IIR filters and analyze their performances.
CO6	Understand the basic concepts of sampling rate conversion and implement them.

Course Name: **ELECTRCAL DISTRIBUTION SYSTEMS(R13&R15)**

	Course Outcomes
C401.1	Identify and categorize the concept includes load distribution, load modeling related to distribution system.
C401.2	Building up analyzing, designing of primary and secondary distribution feeders.
C401.3	Evaluate the solutions of voltage drop and power loss calculations and manual methods of radial network.
C401.4	Able to explain the substations layout showing the location of all

	substations equipment
C401.5	Determines the best capacitor location, Power factor correction, capacitor allocation to enhance the power factor and voltage profile.
C401.6	Involve in lifelong learning to implement modern methods in distribution system in order to meet the demand growth in future.

Course Name: **ENERGY AUDIT AND DEMAND SIDE MANAGEMENT**

	Course Outcomes
CO1	Acquire knowledge about energy auditing and energy requirements and also about global energy scenario.
CO2	Understand about motor energy audit and power factor improvement methods.
CO3	Assess the need and type of instruments for energy audit and energy management and their applications
CO4	Acquire an in-depth knowledge about the energy management.
CO5	Acquire Knowledge about importance of evaluation, measurement and verification of demand side management programs
CO6	Understand various Cost effectiveness test for demand side management programs

Course Name: **HVDC TRANSMISSION(R15&R13)**

	Course Outcomes
C415.1	Understand the concept of HVDC Transmission system over the existing AC transmission and Basic principle and operation of different HVDC converters.
C415.2	Analyze and Apply the different power Converters and control methods to control the transmission system and distribution system
C415.3	Understand the design of filters to eliminate the harmonics to improve the power quality.
C415.4	Analyze different faults in HVDC system.
C415.5	Use modern tools including MATLAB, PSPICE tools to simulate the High transmission system.
C415.6	Engage in independent and lifelong learning in the context of HVDC technological changes

Course Name: **INSTRUMENTATION**

	Course Outcomes
CO1	Understand the various concepts in characteristics of signals and errors in measurements along with signals and their representation for electronic instruments.
CO2	Carry out the analysis of data transmission and telemetry system which is intermediate stage in instrumentation.
CO3	Understand the data acquisition system components and record the data in analog and digital format.
CO4	Analyze the signals employing signal analyzers and learn the measurement of non- electrical quantities like flow and pressure.
CO5	Realize the different types of transducers along with their advantages and disadvantages which are primary sensing element in instrumentation.
CO6	Implement the Measurement of non- electrical quantities employing various instruments.

Course Name: **POWER QUALITY**

	Course Outcomes
CO1	Understand the importance of Power Quality and obtain a brief idea of all power quality issues
CO2	Comprehend the categories and characteristics of electromagnetic phenomenon on power systems, transients, short duration and long duration variations
CO3	Understand the principles and devices for voltage regulation
CO4	Study the nature of harmonics and evaluate certain methods to control harmonics distortions by applying various principles
CO5	Learn about bench marking process, monitoring considerations, assessment of power quality measurement data and operation of monitoring equipment
CO6	Understand the principles of operation of custom power devices which include SSCL, SSB, SSTS, DVR and UPQC.

Course Name: **POWER SYSTEM AND SIMULATION LABORATORY**

	Course Outcomes
CO1	Determine the positive, negative and zero sequence impedances of cylindrical rotor synchronous machine
CO2	Carry out the fault analysis for various types of faults involving LG, LL, LLG and LLLG Faults
CO3	Determine Sub transientreactance of salient pole synchronous machine and Equivalent circuit of three winding transformer.
CO4	Carry out the analysis of formation of Y bus and Z bus applying MATLAB

CO5	Carry out the analysis of load flows involving Newton Raphson Method and Fast Decoupled Method applying MATLAB
CO6	Develop a Simulink model for the problem of load frequency control involving single area and multi area systems

Course Name: **POWER SYSTEM OPERATION AND CONTROL**

	Course Outcomes
CO1	Analyze optimal operation of generators in thermal power plants without and with transmission losses.
CO2	Interpret the importance of hydro thermal scheduling for long term and short term scheduling problems.
CO3	Model the turbine, governor and generator load model mathematically and design the block diagram for load frequency control.
CO4	Analyze the steady state response, dynamic response, load frequency control and economic dispatch control for two or more interconnected systems.
CO5	Investigate the various methods of reactive power compensation in transmission system.
CO6	Recognize the necessity for power system rescheduling and various key issues in deregulation

Course Name: **UTILISATION OF ELECTRICAL ENERGY**

	Course Outcomes
CO1	Explain the basic principles of light control and Different sources of Light
CO2	Understand the various electric heating methods, equipment required for welding and also the difference between AC and DC welding .
CO3	Interpret about the movement of a train and corresponding arrangements and also the features of a Traction Motor.
CO4	Analyze the methods of controlling the trains electrically, terms related to electric traction and calculations of various parameters related to it
CO5	Carry out a detailed review of existing Electric Traction Systems in India and analysis of Energy consumption in Electric Traction
CO6	Engage in lifelong learning to develop modern methods in the prospect of optimum utilization of electrical energy for real world usage.