PRIST
DEEMED TO BE
UNIVERSITY
NAAC ACCREDITED
THANJAVUR – 613 403 - TAMIL NADU

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

B.TECH - FULL TIME (UG - 2019)

COURSE CODE	COURSE TITLE	CO	COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012
19147S11	COMMUNICATIVE ENGLISH	CO1	Read articles of a general kind in magazines and newspapers.					✓							
		CO2	Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.										✓		
		CO3	Comprehend conversations and short talks delivered in English									✓			

		CO4	Write short essays of a general kind and personal letters and emails in English.										✓		
19148S12	**ENGINEERING MATHEMATICS – I**	**CO1**	Use both the limit definition and rules of differentiation to differentiate functions.												✓
		CO2	Apply differentiation to solve maxima and minima problems.		✓										
		CO3	Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.				✓								
		CO4	Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.									✓			
		CO5	Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.											✓	
		CO6	Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.				✓								
		CO7	Apply various techniques in solving differential equations.												✓

19149S13	**ENGINEERING PHYSICS**	**CO1**	the students will gain knowledge on the basics of properties of matter and its applications,						✓							
		CO2	the students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,		✓											
		CO3	the students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,			✓										
		CO4	the students will get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscopes, and		✓										✓	
		CO5	the students will understand the basics of crystals, their structures and different crystal growth techniques.					✓								
19149S14	**ENGINEERING CHEMISTRY**	**CO1**	The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.								✓					
19154S15	**ENGINEERING GRAPHICS**	**CO1**	familiarize with the fundamentals and standards of Engineering graphics							✓						

		CO2	perform freehand sketching of basic geometrical constructions and multiple views of objects.			✓									
		CO3	project orthographic projections of lines and plane surfaces.											✓	
		CO4	draw projections and solids and development of surfaces.						✓						
		CO5	visualize and to project isometric and perspective sections of simple solids.			✓									
17150S16	**PROBLEM SOLVING AND PYTHON PROGRAMMING**	**CO1**	Develop algorithmic solutions to simple computational problems	✓											
		CO2	Read, write, execute by hand simple Python programs.		✓										
		CO3	Structure simple Python programs for solving problems.								✓				
		CO4	Decompose a Python program into functions.					✓							
		CO5	Represent compound data using Python lists, tuples, dictionaries.									✓			
		CO6	Read and write data from/to files in Python Programs.						✓						
19150L17	**PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY**	**CO1**	Write, test, and debug simple Python programs.												✓
		CO2	Implement Python programs with conditionals and loops.										✓		
		CO3	Develop Python programs step-wise by defining functions and calling them.							✓					

		CO4	Use Python lists, tuples, dictionaries for representing compound data.				✓								
		CO5	Read and write data from/to files in Python.						✓						
19150L18	**PHYSICS AND CHEMISTRY LABORATORY**	**CO1**	apply principles of elasticity, optics and thermal properties for engineering applications.		✓										
19147S21	**TECHNICAL ENGLISH**	**CO1**	Read technical texts and write area- specific texts effortlessly.												✓
		CO2	Listen and comprehend lectures and talks in their area of specialisation successfully.										✓		
		CO3	Speak appropriately and effectively in varied formal and informal contexts.						✓						
		CO4	Write reports and winning job applications.			✓									
17148S22A	**ENGINEERING MATHEMATICS – II**	**CO1**	Eigen values and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.					✓							✓
		CO2	Gradient, divergence and curl of a vector point function and related identities.									✓			

		CO3	Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.		✓										
		CO4	Analytic functions, conformal mapping and complex integration.												✓
		CO5	Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.								✓				
19148S22A	**PHYSICS FOR ELECTRONICS ENGINEERING**	**CO1**	gain knowledge on classical and quantum electron theories, and energy band structuues,					✓							
		CO2	acquire knowledge on basics of semiconductor physics and its applications in various devices,												
		CO3	get knowledge on magnetic and dielectric properties of materials,												✓
		CO4	have the necessary understanding on the functioning of optical materials for optoelectronics,								✓				
		CO5	understand the basics of quantum structures and their applications in spintronics and carbon electronics.		✓										
19149S24A	**ENVIRONMENTAL SCIENCE AND ENGINEERING**	**CO1**	Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.				✓								

		CO2	Public awareness of environmental is at infant stage.		✓										
		CO3	Ignorance and incomplete knowledge has lead to misconceptions									✓			
		CO4	Development and improvement in std. of living has lead to serious environmental disasters									✓			
19153S25C	**CIRCUIT THEORY**	**CO1**	Ability to analyse electrical circuits									✓			
		CO2	Ability to apply circuit theorems												
		CO3	Ability to analyse transients							✓					
19154S26C	**BASIC CIVIL AND MECHANICAL ENGINEERING**	**CO1**	appreciate the Civil and Mechanical Engineering components of Projects.				✓								
		CO2	explain the usage of construction material and proper selection of construction materials.												
		CO3	measure distances and area by surveying	✓											
		CO4	identify the components used in power plant cycle.				✓								
		CO5	demonstrate working principles of petrol and diesel engine.												✓
		CO6	elaborate the components of refrigeration and Air conditioning cycle.										✓		
19154L27	**EngineeringPracticesLaboratory**	**CO1**	fabricate carpentry components and pipe connections including plumbing works.									✓			
		CO2	use welding equipments to join the structures.						✓						
		CO3	Carry out the basic machining operations						✓						
		CO4	Make the models using sheet metal works						✓						

		CO5	Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundary and fittings											✓	
		CO6	Carry out basic home electrical works and appliances							✓					
		CO7	Measure the electrical quantities					✓							
		CO8	Elaborate on the components, gates, soldering practices.				✓								
19153L28C	**ELECTRIC CIRCUITS LABORATORY**	**CO1**	Understand and apply circuit theorems and concepts in engineering applications.	✓											
		CO2	Simulate electric circuits.										✓		
19149S31C	**TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS**	**CO1**	Understand how to solve the given standard partial differential equations.				✓								
		CO2	Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.										✓		
		CO3	Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.												✓
		CO4	Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.											✓	
		CO5	Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.									✓			

19153C32	**DIGITAL LOGIC CIRCUITS**	**CO1**	Ability to design combinational and sequential Circuits.			✓									
		CO2	Ability to simulate using software package.		✓										
		CO3	Ability to study various number systems and simplify the logical expressions using Boolean functions		✓										
		CO4	Ability to design various synchronous and asynchronous circuits.	✓											
		CO5	Ability to introduce asynchronous sequential circuits and PLDs	✓											
		CO6	Ability to introduce digital simulation for development of application oriented logic circuits.	✓											
19153C33	**ELECTROMAGNETIC THEORY**	**CO1**	Ability to understand the basic mathematical concepts related to electromagnetic vector fields.					✓							
		CO2	Ability to understand the basic concepts about electrostatic fields, electrical potential, energy density and their applications.										✓		
		CO3	Ability to acquire the knowledge in magneto static fields, magnetic flux density, vector potential and its applications.									✓			
		CO4	Ability to understand the different methods of emf generation and Maxwell's equations										✓		
		CO5	Ability to understand the basic concepts electromagnetic waves and characterizing parameters												✓

		CO6	Ability to understand and compute Electromagnetic fields and apply them for design and analysis of electrical equipment and systems		✓											
19153C34	**ELECTRICAL MACHINES – I**	**CO1**	Ability to analyze the magnetic-circuits.				✓									
		CO2	Ability to acquire the knowledge in constructional details of transformers.									✓				
		CO3	Ability to understand the concepts of electromechanical energy conversion.												✓	
		CO4	Ability to acquire the knowledge in working principles of DC Generator.				✓									
		CO5	Ability to acquire the knowledge in working principles of DC Motor													✓
		CO6	Ability to acquire the knowledge in various losses taking place in D.C. Machines						✓							
19153C35	**ELECTRON DEVICES AND CIRCUITS**	**CO1**	Explain the structure and working operation of basic electronic devices.		✓											
		CO2	Able to identify and differentiate both active and passive elements			✓										
		CO3	Analyze the characteristics of different electronic devices such as diodes and transistors		✓										✓	
		CO4	Choose and adapt the required components to construct an amplifier circuit.					✓								
		CO5	Employ the acquired knowledge in design and analysis of oscillators								✓					

19153C36	**POWER PLANT ENGINEERING**	**CO1**	Explain the layout, construction and working of the components inside a thermal power plant.							✓					
		CO2	Explain the layout, construction and working of the components inside a Diesel, Gas and Combined cycle power plants.			✓									
		CO3	Explain the layout, construction and working of the components inside nuclear power plants.											✓	
		CO4	Explain the layout, construction and working of the components inside Renewable energy power plants						✓						
		CO5	Explain the applications of power plants while extend their knowledge to power plant economics and environmental hazards and estimate the costs of electrical energy production.			✓									
19153L37	**ELECTRONICS LABORATORY**	**CO1**	Ability to understand and analyse electronic circuits.	✓											
19153L38	**ELECTRICAL MACHINES LABORATORY-I**	**CO1**	Ability to understand and analyze DC Generator		✓										
		CO2	Ability to understand and analyze DC Motor								✓				
		CO3	Ability to understand and analyse Transformers.					✓							
19149C41C	**NUMERICAL METHODS**	**CO1**	Understand the basic concepts and techniques of solving algebraic and transcendental equations.									✓			
		CO2	Appreciate the numerical techniques of interpolation and error approximations in						✓						

			various intervals in real life situations.												
		CO3	Apply the numerical techniques of differentiation and integration for engineering problems.												✓
		CO4	Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations										✓		
		CO5	Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.							✓					
19153C42	**ELECTRICAL MACHINES – II**	**CO1**	Ability to understand the construction and working principle of Synchronous Generator				✓								
		CO2	Ability to understand MMF curves and armature windings.						✓						
		CO3	Ability to acquire knowledge on Synchronous motor.		✓										
		CO4	Ability to understand the construction and working principle of Three phase Induction Motor												✓
		CO5	Ability to understand the construction and working principle of Special Machines										✓		
		CO6	Ability to predetermine the performance characteristics of Synchronous Machines.						✓						

19153C43	**TRANSMISSION AND DISTRIBUTION**	**CO1**	To understand the importance and the functioning of transmission line parameters.			✓									
		CO2	To understand the concepts of Lines and Insulators.					✓							✓
		CO3	To acquire knowledge on the performance of Transmission lines.									✓			
		CO4	To acquire knowledge on Underground Cabilitys		✓										
		CO5	To become familiar with the function of different components used in Transmission and Distribution levels of power system and modelling of these components.												✓
19153C44	**MEASUREMENTS AND INSTRUMENTATION**	**CO1**	To acquire knowledge on Basic functional elements of instrumentation								✓				
		CO2	To understand the concepts of Fundamentals of electrical and electronic instruments					✓							
		CO3	Ability to compare between various measurement techniques												
		CO4	To acquire knowledge on Various storage and display devices												✓
		CO5	To understand the concepts Various transducers and the data acquisition systems								✓				
		CO6	Ability to model and analyze electrical and electronic Instruments and understand the operational features of display Devices and Data Acquisition System.		✓										
19153C45	**LINEAR INTEGRATED**	**CO1**	Ability to acquire knowledge in IC fabrication procedure				✓								

	CIRCUITS AND APPLICATIONS	**CO2**	Ability to analyze the characteristics of Op-Amp		✓										
		CO3	To understand the importance of Signal analysis using Op-amp based circuits.									✓			
		CO4	Functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits.												
		CO5	To understand and acquire knowledge on the Applications of Op-amp									✓			
		CO6	Ability to understand and analyse, linear integrated circuits their Fabrication and Application.									✓			
19153C46	**CONTROL SYSTEMS**	**CO1**	Ability to develop various representations of system based on the knowledge of Mathematics, Science and Engineering fundamentals.												
		CO2	Ability to do time domain and frequency domain analysis of various models of linear system							✓					
		CO3	Ability to interpret characteristics of the system to develop mathematical model.				✓								
		CO4	Ability to design appropriate compensator for the given specifications.												
		CO5	Ability to come out with solution for complex control problem	✓											
		CO6	Ability to understand use of PID controller in closed loop system.				✓								
19153L47	**ELECTRICAL MACHINES LABORATORY - II**	**CO1**	Ability to understand and analyze EMF and MMF methods												✓

		CO2	Ability to analyze the characteristics of V and Inverted V curves										✓		
		CO3	Ability to understand the importance of Synchronous machines									✓			
		CO4	Ability to understand the importance of Induction Machines						✓						
		CO5	Ability to acquire knowledge on separation of losses						✓						
19153L48	**LINEAR AND DIGITAL INTEGRATED CIRCUITS LABORATORY**	**CO1**	Ability to understand and implement Boolean Functions.						✓						
		CO2	Ability to understand the importance of code conversion											✓	
		CO3	Ability to Design and implement 4-bit shift registers							✓					
		CO4	Ability to acquire knowledge on Application of Op-Amp TOTA					✓							
		CO5	Ability to Design and implement counters using specific counter IC.				✓								
19153C51	**POWER SYSTEM ANALYSIS**	**CO1**	Ability to model the power system under steady state operating condition	✓											
		CO2	Ability to understand and apply iterative techniques for power flow analysis										✓		
		CO3	Ability to model and carry out short circuit studies on power system				✓								
		CO4	Ability to model and analyze stability problems in power system										✓		

		CO5	Ability to acquire knowledge on Fault analysis.												✓
		CO6	Ability to model and understand various power system components and carry out power flow, short circuit and stability studies.											✓	
19153C52	**MICROPROCESSORS AND MICROCONTROLLERS**	**CO1**	Ability to acquire knowledge in Addressing modes & instruction set of 8085 & 8051.									✓			
		CO2	Ability to understand the importance of Interfacing			✓									
		CO3	Ability to explain the architecture of Microprocessor and Microcontroller		✓										
		CO4	Ability to write the assembly language programme		✓										
		CO5	Ability to develop the Microprocessor and Microcontroller based applications.	✓											
		CO6	Ability to need & use of Interrupt structure 8085 & 8051.	✓											
19153C53	**POWER ELECTRONICS**	**CO1**	Ability to analyse AC-AC and DC-DC and DC-AC converters.	✓											
		CO2	Ability to choose the converters for real time applications.									✓			
19150FE54A	**RENEWABLE ENERGY SYSTEMS**	**CO1**	Ability to create awareness about renewable Energy Sources and technologies.											✓	
		CO2	Ability to get adequate inputs on a variety of issues in harnessing renewable Energy.				✓								
		CO3	Ability to recognize current and possible future role of renewable energy sources.												✓

		CO4	Ability to explain the various renewable energy resources and technologies and their applications.						✓						
		CO5	Ability to understand basics about biomass energy.		✓										
		CO6	Ability to acquire knowledge about solar energy.			✓									
19153C55	**DIGITAL SIGNAL PROCESSING**	**CO1**	Ability to understand the importance of Fourier transform, digital filters and DS Processors.		✓									✓	
		CO2	Ability to acquire knowledge on Signals and systems & their mathematical representation					✓							
		CO3	Ability to understand and analyze the discrete time systems.								✓				
		CO4	Ability to analyze the transformation techniques & their computation.							✓					
		CO5	Ability to analyze the transformation techniques & their computation.			✓									
		CO6	Ability to acquire knowledge on programmability digital signal processor & quantization effects.											✓	
19153C56	**OBJECT ORIENTED PROGRAMMING**	**CO1**	Develop Java programs using OOP principles						✓						
		CO2	Develop Java programs with the concepts inheritance and interfaces			✓									
		CO3	Build Java applications using exceptions and I/O streams	✓											
		CO4	Develop Java applications with threads and generics classes		✓										

		CO5	Develop interactive Java programs using swings								✓				
19153L57	**CONTROL AND INSTRUMENTATION LABORATORY**	**CO1**	Ability to understand control theory and apply them to electrical engineering problems.					✓							
		CO2	Ability to analyze the various types of converters									✓			
		CO3	Ability to design compensators						✓						
		CO4	Ability to understand the basic concepts of bridge networks.												✓
		CO5	Ability to the basics of signal conditioning circuits										✓		
		CO6	Ability to study the simulation packages.							✓					
19153L58	**OBJECT ORIENTED PROGRAMMING LABORATORY**	**CO1**	Develop and implement Java programs with arraylist, exception handling and multithreading .				✓								
		CO2	Design applications using file processing, generic programming and event handling.						✓						
19153L59	**PROFESSIONAL COMMUNICATION**	**CO1**	Make effective presentations		✓										
		CO2	Participate confidently in Group Discussions												✓
		CO3	Attend job interviews and be successful in them										✓		

		CO4	Develop adequate Soft Skills required for the workplace						✓						
19153C61	**SOLID STATE DRIVES**	**CO1**	Ability to understand and suggest a converter for solid state drive.			✓									
		CO2	Ability to select suitability drive for the given application					✓							✓
		CO3	Ability to study about the steady state operation and transient dynamics of a motor load system.									✓			
		CO4	Ability to analyze the operation of the converter/chopper fed dc drive		✓										
		CO5	Ability to analyze the operation and performance of AC motor drives												✓
		CO6	Ability to analyze and design the current and speed controllers for a closed loop solid state DC motor drive.								✓				
19153C62	**PROTECTION AND SWITCHGEAR**	**CO1**	Ability to understand and analyze Electromagnetic and Static Relays.					✓							
		CO2	Ability to suggest suitability circuit breaker												

		CO3	Ability to find the causes of abnormal operating conditions of the apparatus and system.												✓
		CO4	Ability to analyze the characteristics and functions of relays and protection schemes								✓				
		CO5	Ability to study about the apparatus protection, static and numerical relays.		✓										
		CO6	Ability to acquire knowledge on functioning of circuit breaker				✓								
19153C63	**EMBEDDED SYSTEMS**	**CO1**	Ability to understand and analyze Embedded systems.		✓										
		CO2	Ability to suggest an embedded system for a given application.									✓			
		CO3	Ability to operate various Embedded Development Strategies												
		CO4	Ability to study about the bus Communication in processors.									✓			
		CO5	Ability to acquire knowledge on various processor scheduling algorithms.									✓			
		CO6	Ability to understand basics of Real time operating system.												
19153E64E	**MODERN POWER CONVERTERS**	**CO1**	Ability to suggest converters for AC-DC conversion and SMPS							✓					
19153E65C	**POWER QUALITY**	**CO1**	Ability to understand various sources, causes and effects of power quality issues, electrical systems and their measures and mitigation.				✓								

		CO2	Ability to analyze the causes & Mitigation techniques of various PQ events.													
		CO3	Ability to study about the various Active & Passive power filters.	✓												
		CO4	Ability to understand the concepts about Voltage and current distortions, harmonics.				✓									
		CO5	Ability to analyze and design the passive filters.													✓
		CO6	Ability to acquire knowledge on compensation techniques.											✓		
		CO7	Ability to acquire knowledge on DVR.										✓			
19153L66	**POWER ELECTRONICS AND DRIVES LABORATORY**	**CO1**	Ability to practice and understand converter and inverter circuits and apply software for engineering problems						✓							
		CO2	Ability to experiment about switching characteristics various switches						✓							
		CO3	Ability to analyze about AC to DC converter circuits						✓							
		CO4	Ability to analyze about DC to AC circuits.												✓	
		CO5	Ability to acquire knowledge on AC to AC converters							✓						
		CO6	Ability to acquire knowledge on simulation software					✓								
19153L67	**MICROPROCESSORS AND MICROCONTROLLERS LABORATORY**	**CO1**	Ability to understand and apply computing platform and software for engineering problems				✓									
		CO2	Ability to programming logics for code conversion.	✓												
		CO3	Ability to acquire knowledge on A/D and D/A											✓		

		CO4	Ability to understand basics of serial communication				✓								
		CO5	Ability to understand and impart knowledge in DC and AC motor interfacing										✓		
		CO6	Ability to understand basics of software simulators.												✓
19153MP68	**MINI PROJECT**	**CO1**	On Completion of the mini project work students will be in a position to take up their final year project work and find solution by formulating proper methodology.											✓	
19153C71	**HIGH VOLTAGE ENGINEERING**	**CO1**	Ability to understand Transients in power system									✓			
		CO2	Ability to understand Generation and measurement of high voltage			✓									
		CO3	Ability to understand High voltage testing.		✓										
		CO4	Ability to understand various types of over voltages in power system		✓										
		CO5	Ability to measure over voltages.	✓											
		CO6	Ability to test power apparatus and insulation coordination	✓											
19153C72		**CO1**	Ability to understand the day-to-day operation of electric power system.	✓											

	POWER SYSTEM OPERATION AND CONTROL	**CO2**	Ability to analyze the control actions to be implemented on the system to meet the minute to-minute variation of system demand.					✓								
		CO3	Ability to understand the significance of power system operation and control.										✓			
		CO4	Ability to acquire knowledge on real power-frequency interaction											✓			
		CO5	Ability to understand the reactive power-voltage interaction.											✓			
		CO6	Ability to design SCADA and its application for real time operation														✓
19153C73	**RENEWABLE ENERGY SYSTEMS**	**CO1**	Ability to create awareness about renewable Energy Sources and technologies.		✓												
		CO2	Ability to get adequate inputs on a variety of issues in harnessing renewable Energy.				✓										
		CO3	Ability to recognize current and possible future role of renewable energy sources.											✓			
		CO4	Ability to explain the various renewable energy resources and technologies and their applications.													✓	
		CO5	Ability to understand basics about biomass energy				✓										
		CO6	Ability to acquire knowledge about solar energy.														✓
19154FE74B	**TESTING OF MATERIALS**	**CO1**	Identify suitable testing technique to inspect industrial component						✓								

		CO2	ability to use the different technique and know its application and limitation		✓											
19153E75A	**DISASTER MANAGEMENT**	**CO1**	Differentiate the types of disasters, causes and their impact on environment and society			✓										
		CO2	Assess vulnerability and various methods of risk reduction measures as well as mitigation.		✓										✓	
		CO3	Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.					✓								
19153E76F	**TOTAL QUALITY MANAGEMENT**	**CO1**	The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.								✓					
19153L77	**POWER SYSTEM SIMULATION LABORATORY**	**CO1**	Ability to understand power system planning and operational studies.							✓						
		CO2	Ability to acquire knowledge on Formation of Bus Admittance and Impedance Matrices and Solution of Networks			✓										
		CO3	Ability to analyze the power flow using GS and NR method												✓	
		CO4	Ability to find Symmetric and Unsymmetrical fault						✓							
		CO5	Ability to understand the economic dispatch			✓										
		CO6	Ability to analyze the electromagnetic transients.	✓												
19153L78		**CO1**	Ability to understand and analyze Renewable energy systems.		✓											

	RENEWABLE ENERGY SYSTEMS LABORATORY	**CO2**	Ability to train the students in Renewable Energy Sources and technologies.								✓					
		CO3	Ability to provide adequate inputs on a variety of issues in harnessing Renewable Energy.					✓								
		CO4	Ability to simulate the various Renewable energy sources.									✓				
		CO5	Ability to recognize current and possible future role of Renewable energy sources						✓							
		CO6	Ability to understand basics of Intelligent Controllers.													✓
19153E81G	**PRINCIPLES OF MANAGEMENT**	**CO1**	Upon completion of the course, students will be ability to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management											✓		
19153E82F	**BIOMEDICAL INSTRUMENTATION**	**CO1**	Ability to understand the philosophy of the heart, lung, blood circulation and respiration system.							✓						
		CO2	Ability to provide latest ideas on devices of non-electrical devices.				✓									
		CO3	Ability to gain knowledge on various sensing and measurement devices of electrical origin.						✓							
		CO4	Ability to understand the analysis systems of various organ types.		✓											

		CO5	Ability to bring out the important and modern methods of imaging techniques and their analysis.													✓
		CO6	Ability to explain the medical assistance/techniques, robotic and therapeutic equipments.												✓	
19153P81	**PROJECTWORK**	**CO1**	On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.						✓							

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

B.TECH - PART TIME (UG - 2019)

COURSE CODE	**COURSE TITLE**	**CO**	**COURSE OUTCOMES**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO 12**
19148S11P	**TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS**	**CO1**	Understand how to solve the given standard partial differential equations.					✓							
		CO2	Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.										✓		
		CO3	Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.									✓			
		CO4	Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.										✓		

		CO5	Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.													✓
19153H12P	**CONTROL SYSTEM**	**CO1**	To understand the methods of representation of systems and getting their transfer function models		✓											
		CO2	To provide adequate knowledge in the time response of systems and steady state error analysis				✓									
		CO3	To give basic knowledge is obtaining the open loop and closed–loop frequency responses of systems										✓			
		CO4	To understand the concept of stability of control system and methods of stability analysis												✓	
		CO5	To study the three ways of designing compensation for a control system				✓									
19153H13P	**CIRCUIT ANALYSIS AND NETWORKS**	**CO1**	To study about various network theorems and the method of application to analyse a circuit.													✓
		CO2	To know the concept of transfer function of a network and the nature of response to external inputs						✓							
		CO3	To synthesize a network in different forms from the transfer function.		✓											
		CO4	To know the concept and design of frequency selective filters.			✓										

19153H14P	**ELECTRONIC CIRCUITS**	**CO1**	To acquaint the students with construction, theory and characteristics of the following electronic devices		✓									✓	
		CO2	Bipolar transistor, Field Effect transistor, Multivibrators, Power control/regulator devices, Feedback amplifiers and oscillators					✓							
19153H15P	**ELECTRICAL MACHINES – I**	**CO1**	To introduce the concept of rotating machines and the principle of electromechanical energy conversion in single and multiple excited systems.								✓				
		CO2	To understand the generation of D.C. voltages by using different type of generators and study their performance.							✓					
		CO3	To study the working principles of D.C. motors and their load characteristics, starting and methods of speed control.			✓									
		CO4	To familiarize with the constructional details of different type of transformers, working principle and their performance.											✓	
		CO5	To estimate the various losses taking place in D.C. machines and transformers and to study the different testing method to arrive at their performance.						✓						
19148S21P	**NUMERICAL METHODS**	**CO1**	Apply the basic concepts of classifications of design of experiments in the field of agriculture.			✓									

		CO2	Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.	✓											
		CO3	Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.		✓										
		CO4	Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications								✓				
19150S22P	**COMPUTER ARCHITECTURE**	**CO1**	Computer arithmetic and logic unit design.					✓							
		CO2	Input and output organizations and interfacing.									✓			
		CO3	Control Mechanism and CPU functioning.						✓						
		CO4	Pipeline architecture and vector processing.												✓
		CO5	Various memories and their organization.										✓		
19153H23P	**ELECTRICAL MACHINES-II**	**CO1**	Construction and performance of salient and non – salient type synchronous generators.							✓					
		CO2	Principle of operation and performance of synchronous motor.				✓								
		CO3	Construction, principle of operation and performance of induction machines.						✓						
		CO4	Starting and speed control of three-phase induction motors.		✓										
		CO5	Construction, principle of operation and performance of single phase induction motors and special machines.												✓

19153H24P	**DIGITAL ELECTRONICS**	**CO1**	To study various number systems and to simplify the mathematical expressions using Boolean functions simple problems.										✓		
		CO2	To study implementation of combinational circuits						✓						
		CO3	To study the design of various synchronous and asynchronous circuits.			✓									
		CO4	To expose the students to various memory devices.					✓							✓
17153H25P	**TRANSMISSION AND DISTRIBUTION**	**CO1**	To develop expression for computation of fundamental parameters of lines.									✓			
		CO2	To categorize the lines into different classes and develop equivalent circuits for these classes.		✓										
		CO3	To analyze the voltage distribution in insulator strings and cables and methods to improve the same.												✓
19148S31P	**PROBABILITY AND STATISTICS**	**CO1**	To develop expression for computation of fundamental parameters of lines.								✓				
		CO2	To categorize the lines into different classes and develop equivalent circuits for these classes.					✓							
		CO3	To analyze the voltage distribution in insulator strings and cables and methods to improve the same.												
19152S32P	**ANALOG INTEGRATED CIRCUITS**	**CO1**	To study the IC fabrication procedure.												✓
		CO2	To study characteristics; realize circuits; design for signal analysis using Op-amp Ics.								✓				
		CO3	To study the applications of Op-amp.		✓										

		CO4	To study internal functional blocks and the applications of special Ics like Timers, PLL circuits, regulator Circuits, ADCs.				✓								
19153H33P	**POWER ELECTRONICS**	**CO1**	To get an overview of different types of power semiconductor devices and their switching characteristics.		✓										
		CO2	To understand the operation, characteristics and performance parameters of controlled rectifiers									✓			
		CO3	To study the operation, switching techniques and basics topologies of DC-DC switching regulators.												
		CO4	To learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.									✓			
		CO5	To study the operation of AC voltage controller and Matrix converters.									✓			
19153H34P	**MEASUREMENTS AND INSTRUMENTATION**	**CO1**	Introduction to general instrument system, error, calibration etc.												
		CO2	Emphasis is laid on analog and digital techniques used to measure voltage, current, energy and power etc.							✓					
		CO3	To have an adequate knowledge of comparison methods of measurement.				✓								
		CO4	Elaborate discussion about storage & display devices.												
		CO5	Exposure to various transducers and data acquisition system.	✓											

19153L35P	**MACHINES LAB**	**CO1**	apply synchronous Motor				✓										
		CO2	apply Load test on three phase squirrel cage Induction motor														✓
		CO3	applySpeed control of three phase slip ring Induction Motor												✓		
19153H41P	**PROTECTION AND SWITCHGEAR**	**CO1**	To expose the students to the various faults in power system and learn the various methods of protection scheme.											✓			
		CO2	To understand the current interruption in Power System and study the various switchgears						✓								
19153H42P	**HIGH VOLTAGE DC TRANSMISSION**	**CO1**	To study the performance of converters and modeling of DC line with controllers.						✓								
		CO2	To study about converter harmonics and its mitigation using active and passive filters						✓								
19153H43P	**SOLID STATE DRIVES**	**CO1**	To understand the stable steady-state operation and transient dynamics of a motor-load system.												✓		
		CO2	To study and analyze the operation of the converter / chopper fed dc drive and to solve simple problems.							✓							
		CO3	To study and understand the operation of both classical and modern induction motor drives.					✓									
		CO4	To understand the differences between synchronous motor drive and induction motor drive and to learn the basics of permanent magnet synchronous motor drives.				✓										

		CO5	To analyze and design the current and speed controllers for a closed loop solid-state d.c motor drive.	✓											
19153E44CP	**BIOMEDICAL INSTRUMENTATION**	**CO1**	To provide an acquaintance of the physiology of the heart, lung, blood circulation and circulation respiration. Methods of different transducers used.										✓		
		CO2	To introduce the student to the various sensing and measurement devices of electrical origin.				✓								
		CO3	To provide the latest ideas on devices of non-electrical devices.										✓		
		CO4	To bring out the important and modern methods of imaging techniques.												✓
		CO5	To provide latest knowledge of medical assistance / techniques and therapeutic equipments											✓	
19153L45P	**CONTROL SYSTEM & MEASUREMENTS LAB**	**CO1**	To provide a platform for understanding the basic concepts of linear control theory and its application to practical systems and To train the students in the measurement of displacement, resistance, inductance, torque and angle etc., and to give exposure to AC, DC bridges and transient measurement.									✓			
19153H51P	**POWER SYSTEM ANALYSIS**	**CO1**	To model steady-state operation of large-scale power systems and to solve the power flow problems using efficient numerical methods suitable for computer simulation.			✓									

		CO2	To model and analyse power systems under abnormal (fault) conditions.		✓										
		CO3	To model and analyse the dynamics of power system for small-signal and large signal disturbances and o design the systems for enhancing stability		✓										
17153H52P	**POWER QUALITY**	**CO1**	Ability to understand various sources, causes and effects of power quality issues, electrical systems and their measures and mitigation.	✓											
		CO2	Ability to analyze the causes & Mitigation techniques of various PQ events.	✓											
		CO3	Ability to study about the various Active & Passive power filters.	✓											
		CO4	Ability to understand the concepts about Voltage and current distortions, harmonics.					✓							
		CO5	Ability to analyze and design the passive filters.										✓		
		CO6	Ability to acquire knowledge on compensation techniques.									✓			
		CO7	Ability to acquire knowledge on DVR.										✓		
19153H53P	**SPECIAL ELECTRICAL MACHINES**	**CO1**	Construction, principle of operation and performance of synchronous reluctance motors.												✓
		CO2	Construction, principle of operation and performance of stepping motors.		✓										
		CO3	Construction, principle of operation and performance of switched reluctance motors.				✓								

		CO4	Construction, principle of operation and performance of permanent magnet brushless D.C. motors.									✓			
		CO5	Construction, principle of operation and performance of permanent magnet synchronous motors											✓	
19158E54AP	**ENVIRONMENTAL SCIENCE AND ENGINEERING**	**CO1**	Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.				✓								
		CO2	Public awareness of environmental is at infant stage.										✓		
		CO3	Ignorance and incomplete knowledge has lead to misconceptions												✓
19153L55P	**POWER ELECTRONICS & DRIVES LAB**	**CO1**	Development and improvement in std. of living has lead to serious environmental disasters											✓	
19153H61P	**UTILIZATION OF ELECTRICAL ENERGY**	**CO1**	To ensure that the knowledge acquired is applied in various fields as per his job requirements.				✓								
		CO2	To orient the subject matter in the proper direction, visits to industrial establishments are recommended in order to familiarize with the new developments in different areas.										✓		
19153H62P		**CO1**	Advantages of Static Relays												✓

	SOLID STATE RELAYS	**CO2**	Steady State and Transient Performance of Signal Driving Elements											✓	
		CO3	Static Relay Circuits for Generator Loss of Field						✓						
19153H63P	**POWER SYSTEM OPERATION AND CONTROL**	**CO1**	To get an overview of system operation and control.			✓									
		CO2	To understand & model power-frequency dynamics and to design power-frequency controller.	✓											
		CO3	To understand & model reactive power-voltage interaction and different methods of control for maintaining voltage profile against varying system load.		✓										
19160E64AP	**PRINCIPLES OF MANAGEMENT**	**CO1**	Upon completion of the course, students will be ability to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management								✓				
19153L65P	**POWER SYSTEMS LAB**	**CO1**	To simulate analysis and planning cases for a practical power system					✓							
19160S71P	**TOTAL QUALITY MANAGEMENT**	**CO1**	The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.									✓			
19153H72P	**ELECTRICAL MACHINE DESIGN**	**CO1**	Construction, principle of operation and performance of DC machine.						✓						
		CO2	Construction, operating Characteristics of single and three phase transformer.												✓

		CO3	Design and operating characteristics of Induction motors.										✓			
		CO4	Construction, principle of operation, Design of synchronous machines and to have knowledge of machine design in CAD							✓						
19153H73P	**POWER PLANT ENGINEERING**	**CO1**	Explain the layout, construction and working of the components inside a thermal power plant.				✓									
		CO2	Explain the layout, construction and working of the components inside a Diesel, Gas and Combined cycle power plants.						✓							
		CO3	Explain the layout, construction and working of the components inside nuclear power plants.		✓											
		CO4	Explain the layout, construction and working of the components inside Renewable energy power plants													✓
		CO5	Explain the applications of power plants while extend their knowledge to power plant economics and environmental hazards and estimate the costs of electrical energy production.										✓			
19153E74AP	**POWER SYSTEM TRANSIENTS**	**CO1**	To study the generation of switching transients and their control using circuit – theoretical concept.						✓							
		CO2	To study the mechanism of lighting strokes and the production of lighting surges.		✓											
		CO3	To study the propagation, reflection and refraction of travelling waves.													✓

		CO4	To study the impact of voltage transients caused by faults, circuit breaker action, load rejection on integrated power system.										✓		
19153P75P	**PROJECTWORK**	**CO1**	On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.						✓						

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

M.TECH(POWER SYSTEM) - FULL TIME (PG - 2019)

COURSE CODE	**COURSE TITLE**	**CO**	**COURSE OUTCOMES**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO 12**
19248S11D	**APPLIED MATHEMATICS FOR ELECTRICAL &ELECTRONICS ENGINEERING**	**CO1**	Understand Finite differences, interpolation techniques, Numerical differentiation and Integration and apply it to various practical problems										✓		
		CO2	Apply Numerical methods to solve first order ordinary differential equations and Algebraic and Transcendental equations				✓								
		CO3	Illustrate Laplace transform and its application in different fields										✓		
		CO4	Apply Fourier transforms and its applications to solve Ordinary and Partial differential equations												✓
		CO5	Use Z-transform and its applications to solve difference equations											✓	
19272C12	**SYSTEM THEORY**	**CO1**	Basics of linear theory/linear algebra									✓			

		CO2	State-space models, Transition matrix properties, Minimal realization, Controllability, Observability.			✓									
		CO3	Internal Stability, Lyapunov Stability theorems for linear systems, Linear Feedback and Observers, Separation Principle.		✓										
19272C13	**POWER SYSTEM MODELLING AND ANALYSIS**	**CO1**	To review Deep concepts of Power System in the field of Power System.		✓										
		CO2	To address the underlying concepts and methods behind Advanced Power System	✓											
		CO3	To impart knowledge of advancement in the field of power system with insight experimental approach.	✓											
19272C14	**ECONOMIC OPERATIONS OF POWER SYSTEMS-I**	**CO1**	This course also introduces optimization methods and their application in practical power system operation problems.	✓											
		CO2	This course provides application of modern numerical techniques and analytical methods for dealing with and solving operation-related problems in electric power systems.					✓							

		CO3	The primary objective of this course is to analyze efficient and optimum operation of electric power generation system and to provide an overview about the control techniques adopted to ensure the economic operation of a power system.										✓		
19272C15	**HIGH VOLTAGE DIRECT CURRENT TRANSMISSION SYSTEM**	**CO1**	In early invention of electric energy, dc power was used but due to limitations of low voltage dc systems, ac systems become popular.									✓			
		CO2	the factors such as are reactive power, stability, power control, etc, impose limitations on the amount of power to be transmitted over ac lines.										✓		
		CO3	There are still several limitations of HVDC transmission. Therefore, the transmission system is mixed of HVAC and HVDC systems												✓
19272L17	**POWER SYSTEM SIMULATION LABORATORY – I**	**CO1**	Formation of Y bus, Z bus, line parameters and modeling of transmission lines.		✓										
		CO2	Power flow analysis: Gauss – Seidel Method.				✓								
		CO3	Power flow analysis: Newton Raphson method.									✓			
		CO4	Plain Decoupled and Fast Decoupled methods.											✓	

19272C21	**EHV POWER TRANSMISSION**	**CO1**	Students would be introduced to the issues in designing power transmission lines operating at EHV/UHV voltages especially about insulation design, corona losses, audible noise , insulation co-ordination, electric field under the lines, issues due to mechanical vibrations of overhead power transmission lines and their mitigation etc.				✓									
19272C22	**ECONOMIC OPERATIONS OF POWER SYSTEMS-II**	**CO1**	This course also introduces optimization methods and their application in practical power system operation problems.													✓
		CO2	This course provides application of modern numerical techniques and analytical methods for dealing with and solving operation-related problems in electric power systems.					✓								
		CO3	The primary objective of this course is to analyze efficient and optimum operation of electric power generation system and to provide an overview about the control techniques adopted to ensure the economic operation of a power system.		✓											
19272C23	**POWER SYSTEM PROTECTION**	**CO1**	Discuss performance of protective relays, components of protection scheme and relay terminology over current protection.			✓										
		CO2	Explain the working of distance relays and the effects of arc resistance, power swings, line length and source impedance on performance of distance relays.		✓										✓	

		CO3	Discuss pilot protection, construction, operating principles and performance ofdifferential relays and discuss protection of generators, motors, transformer and Bus Zone Protection.					✓							
		CO4	Explain the construction and operation of different types of circuit breakers.								✓				
		CO5	Outline features of fuse, causes of overvoltages and its protection, also modern trends in Power System Protection.							✓					
19272E24B	**POWER SYSTEM PLANNING AND RELIABILITY**	**CO1**	Discuss primary components of power system planning, planning methodology for optimum power system expansion, various types of generation, transmission and distribution.			✓									
		CO2	Show knowledge of forecasting of future load requirements of both demand and energy by deterministic and statistical techniques using forecasting tools.											✓	
		CO3	Discuss methods to mobilize resources to meet the investment requirement for the power sector						✓						
		CO4	Understand economic appraisal to allocate the resources efficiently and appreciate the investment decisions			✓									
		CO5	Discuss expansion of power generation and planning for system energy in the country, evaluation of operating states of transmission system, their associated contingencies and the stability of the system.	✓											

		CO6	Discuss principles of distribution planning, supply rules, network development and the system studies		✓											
		CO7	Discuss reliability criteria for generation, transmission, distribution and reliability evaluation and analysis, grid reliability, voltage disturbances and their remedies								✓					
		CO8	Discuss planning and implementation of electric –utility activities, market principles and the norms framed by CERC for online trading and exchange in the interstate power market.					✓								
19272E25A	**WIND ENERGY CONVERSION SYSTEMS**	**CO1**	Explain the basics of solar energy conversion systems.										✓			
		CO2	Design a standalone PV system.						✓							
		CO3	Describe different wind energy conversion systems.													✓
19272L26	**POWER SYSTEM SIMULATION LAB – II**	**CO1**	To provide better understanding of power system analysis through digital simulation.											✓		
19272C31	**ELECTRICAL TRANSIENTS IN POWER SYSTEMS**	**CO1**	A quantitative foundation of the mechanism of lighting strokes and the production of lighting surges to understand how the various types of Transients in the system produced.							✓						
		CO2	Obtain the theoretic basis of the propagation, reflection and refraction of travelling waves for modeling of transmission line travelling waves				✓									

		CO3	Grasp the concepts of the impact of voltage transients caused by circuit breaker action, switching on integrated power system.						✓							
		CO4	Design of Insulations under the presence of transients and protection of power system against transient over voltages.		✓											
19272C32A	**POWER ELECTRONICS APPLICATIONS IN POWER SYSTEMS**	**CO1**	To understand basic power electronic devices and their role in power conversion													✓
		CO2	· To study basic topologies of various converter										✓			
19272E33A	**POWER CONDITIONING**	**CO1**	Reliably identify the sources of various power quality problems.						✓							
		CO2	Explain about causes of harmonic and its distortion effect.							✓						
		CO3	Estimate the impact of various power quality problems on appliances.				✓									
		CO4	Educate the harmful effects of poor power quality and harmonics.						✓							
		CO5	Decide the compensators and filters to keep the power quality indices within the standards.		✓											
19272E34A	**SOFTWARE FOR CONTROL SYSTEM DESIGN**	**CO1**	Used for problem-solving and control system design							✓						
		CO2	Used for modeling plant dynamics, designing control algorithms, and running closed-loop simulations				✓									

19272P35	**PROJECT WORK PHASE-I**	**CO1**	On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.						✓						
19272P44	**PROJECT WORK PHASE-II**	**CO1**	On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.		✓										

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

M.TECH (POWER SYSTEM) - PART TIME (PG - 2019)

COURSE CODE	COURSE TITLE	CO	COURSE OUTCOMES	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO 12
19248S11DP	**APPLIED MATHEMATICS FOR ELECTRICAL & LECTRONICS ENGINEERING**	**CO1**	Understand Finite differences, interpolation techniques, Numerical differentiation and Integration and apply it to various practical problems										✓		
		CO2	Apply Numerical methods to solve first order ordinary differential equations and Algebraic and Transcendental equations				✓								
		CO3	Illustrate Laplace transform and its application in different fields										✓		
		CO4	Apply Fourier transforms and its applications to solve Ordinary and Partial differential equations												✓
		CO5	Use Z-transform and its applications to solve difference equations											✓	

19272C12P	**SYSTEM THEORY**	**CO1**	Basics of linear theory/linear algebra									✓			
		CO2	State-space models, Transition matrix properties, Minimal realization, Controllability, Observability.			✓									
		CO3	Internal Stability, Lyapunov Stability theorems for linear systems, Linear Feedback and Observers, Separation Principle.		✓										
19272C13P	**POWER SYSTEM MODELLING AND ANALYSIS**	**CO1**	To review Deep concepts of Power System in the field of Power System.		✓										
		CO2	To address the underlying concepts and methods behind Advanced Power System	✓											
		CO3	To impart knowledge of advancement in the field of power system with insight experimental approach.	✓											
19272L14P	**POWER SYSTEM SIMULATION LAB – I**	**CO1**	Formation of Y bus, Z bus, line parameters and modeling of transmission lines.	✓											
		CO2	Power flow analysis: Gauss – Seidel Method.					✓							
		CO3	Power flow analysis: Newton Raphson method.										✓		
		CO4	Plain Decoupled and Fast Decoupled methods.									✓			
19272C21P	**EHV POWER TRANSMISSION**	**CO1**	Students would be introduced to the issues in designing power transmission lines operating at EHV/UHV voltages especially about insulation design, corona losses, audible noise , insulation co-ordination, electric field under the lines, issues due to mechanical vibrations of overhead power transmission lines and their mitigation etc.										✓		

19272C22P	**POWER SYSTEM PROTECTION**	**CO1**	Discuss pilot protection, construction, operating principles and performance ofdifferential relays and discuss protection of generators, motors, transformer and Bus Zone Protection.													✓
		CO2	Explain the construction and operation of different types of circuit breakers.		✓											
		CO3	Outline features of fuse, causes of overvoltages and its protection, also modern trends in Power System Protection.				✓									
19272E23BP	**POWER SYSTEM PLANNING AND RELIABILITY**	**CO1**	Discuss primary components of power system planning, planning methodology for optimum power system expansion, various types of generation, transmission and distribution.									✓				
		CO2	Show knowledge of forecasting of future load requirements of both demand and energy by deterministic and statistical techniques using forecasting tools.											✓		
		CO3	Discuss methods to mobilize resources to meet the investment requirement for the power sector				✓									
		CO4	Understand economic appraisal to allocate the resources efficiently and appreciate the investment decisions													✓
		CO5	Discuss expansion of power generation and planning for system energy in the country, evaluation of operating states of transmission system, their associated contingencies and the stability of the system.						✓							

		CO6	Discuss principles of distribution planning, supply rules, network development and the system studies		✓										
		CO7	Discuss reliability criteria for generation, transmission, distribution and reliability evaluation and analysis, grid reliability, voltage disturbances and their remedies			✓									
		CO8	Discuss planning and implementation of electric –utility activities, market principles and the norms framed by CERC for online trading and exchange in the interstate power market.		✓									✓	
19272C31P	**ECONOMIC OPERATIONS OF POWER SYSTEMS-I**	**CO1**	This course also introduces optimization methods and their application in practical power system operation problems.					✓							
		CO2	This course provides application of modern numerical techniques and analytical methods for dealing with and solving operation-related problems in electric power systems.								✓				
		CO3	The primary objective of this course is to analyze efficient and optimum operation of electric power generation system and to provide an overview about the control techniques adopted to ensure the economic operation of a power system.							✓					
19272C32P	**HIGH VOLTAGE DIRECT CURRENT**	**CO1**	In early invention of electric energy, dc power was used but due to limitations of low voltage dc systems, ac systems become popular.			✓									

	TRANSMISSION SYSTEM	**CO2**	the factors such as are reactive power, stability, power control, etc, impose limitations on the amount of power to be transmitted over ac lines.											✓	
		CO3	There are still several limitations of HVDC transmission. Therefore, the transmission system is mixed of HVAC and HVDC systems						✓						
19272E33AP	**ANALYSIS OF INVERTERS**	**CO1**	To provide the electrical circuit concepts behind the different working modes of inverters so as to enable deep understanding of their operation.			✓									
		CO2	To equip with required skills to derive the criteria for the design of inverters for UPS, drives etc.,	✓											
		CO3	To analyse and comprehend the various operating modes of different configuration of inverters.		✓										
19272L34P	**POWER SYSTEM SIMULATION LAB – II**	**CO1**	To provide better understanding of power system analysis through digital simulation.								✓				
19272C41P	**ECONOMIC OPERATIONS OF POWER SYSTEMS-II**	**CO1**	This course also introduces optimization methods and their application in practical power system operation problems.					✓							
		CO2	This course provides application of modern numerical techniques and analytical methods for dealing with and solving operation-related problems in electric power systems.									✓			

		CO3	The primary objective of this course is to analyze efficient and optimum operation of electric power generation system and to provide an overview about the control techniques adopted to ensure the economic operation of a power system.						✓						
19272C42P	**ELECTRICAL TRANSIENTS IN POWER SYSTEMS**	**CO1**	A quantitative foundation of the mechanism of lighting strokes and the production of lighting surges to understand how the various types of Transients in the system produced.												✓
		CO2	Obtain the theoretic basis of the propagation, reflection and refraction of travelling waves for modeling of transmission line travelling waves										✓		
		CO3	Grasp the concepts of the impact of voltage transients caused by circuit breaker action, switching on integrated power system.							✓					
		CO4	Design of Insulations under the presence of transients and protection of power system against transient over voltages.				✓								
19272E43AP	**WIND ENERGY CONVERSION SYSTEMS**	**CO1**	Explain the basics of solar energy conversion systems.						✓						
		CO2	Design a standalone PV system.		✓										
		CO3	Describe different wind energy conversion systems.												✓

19272P44P	**PROJECT WORK PHASE-I**	**CO1**	On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.										✓		
19272E53AP	**SOFTWARE FOR CONTROL SYSTEM DESIGN**	**CO1**	Used for problem-solving and control system design						✓						
		CO2	Used for modeling plant dynamics, designing control algorithms, and running closed-loop simulations							✓					
19272E52AP	**POWER CONDITIONING**	**CO1**	Reliably identify the sources of various power quality problems.				✓								
		CO2	Explain about causes of harmonic and its distortion effect.						✓						
		CO3	Estimate the impact of various power quality problems on appliances.		✓										
		CO4	Educate the harmful effects of poor power quality and harmonics.							✓					
		CO5	Decide the compensators and filters to keep the power quality indices within the standards.				✓								
19272E51BP	**POWER SYSTEM DYNAMICS**	**CO1**	This course first introduces a student to power stability problems and the basic concepts of modeling and analysis of dynamical systems.						✓						
		CO2	Modeling of power system components - generators, transmission lines, excitation and prime mover controllers		✓										

		CO3	Stability of single machine and multi-machine systems is analyzed using digital simulation and small-signal analysis techniques.							✓						
		CO4	The impact of stability problems on power system planning, and operation is also brought out.				✓									
19272P61P	**PROJECT WORK PHASE-II**	**CO1**	On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.				✓									