

**Mewar University, Gangrar**  
**Department of Electrical Engineering**

**[A] Programme Outcomes (POs) for B.Tech.(EE):**

**Engineering Graduates will be able to:**

	Program Outcome
PO1.	<b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2.	<b>Problem analysis:</b> Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3.	<b>Design/development of solutions:</b> Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4.	<b>Conduct investigations of complex problems:</b> Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5.	<b>Modern tool usage:</b> Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6.	<b>The engineer and society:</b> Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7.	<b>Environment and sustainability:</b> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8.	<b>Ethics:</b> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9.	<b>Individual and team work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10.	<b>Communication:</b> Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11.	<b>Project management and finance:</b> Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12.	<b>Life-long learning:</b> Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**[B] Course Outcomes (COs) for B.Tech.(EE):**

<b>Sr. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Course Outcomes</b>
<b>FIRST SEMESTER</b>			
1	<b>BS-101</b>	<b>ENGINEERING PHYSICS-I</b>	The objective of teaching engineering physics is to give an understanding of the basic knowledge and impart quality education in physical sciences to the budding engineers. To strengthen the skills in basic measurements by exposing the students to well equipped labs and enhance the problem solving ability through interactive classes.
2	<b>BS-103</b>	<b>ENGINEERING MATHEMATICS-I</b>	An effective knowledge of mathematics for all engineering students is a necessary requirement for the education of qualified engineering graduates capable both of innovation and of adaptation to changing technology. After completing the syllabus, Students can better understand the mathematical terms used to solve the engineering problems under different conditions.
3	<b>BS-105</b>	<b>ENGINEERING CHEMISTRY</b>	It is essential that one has to understand the fundamentals of basic sciences before trying to learn their application in various branches. In framing the curriculum of chemistry, emphasis has been laid on the teaching of such topics, which have a bearing on the topics of various branches of engineering. With this object in view, some important fundamental topics of chemistry have been Included in this syllabus.
4	<b>ES-101</b>	<b>ENGINEERING GRAPHICS &amp; DRAWING</b>	The objective of this course is to accurately and unambiguously capture all the geometric features of a product or a component and convey all the required information that will allow a manufacturer to produce that component.
5	<b>ES-103</b>	<b>FUNDAMENTALS OF COMPUTERS AND PROGRAMMING</b>	To know the components of a Computer System, To understand basic Concepts of Operating System and Computer Networks, To have an overview of different types of operating systems like DOS, UNIX/LINUX Operating System, Windows XP, To have a thorough knowledge of various System Software and Programming languages, To study different kinds of Number system, To

			know the concepts of Problem Solving, To have a thorough knowledge of C language and its programming.
6	<b>ES-105</b>	<b>BASICS OF ELECTRICAL ENGINEERING</b>	Students will be able to learn the fundamentals of Electrical Engineering in Circuit Analysis, Measurements & electrical machines. This will help students of all disciplines to understand the basics of Electrical Engineering.
7	<b>ELGA-101</b>	<b>ENGLISH LANGUAGE AND GENERAL AWARENESS-I</b>	The course is specifically focused on laying a firm foundation for English language proficiency by helping students build a strong base in Grammar and vocabulary.
<b>SECOND SEMESTER</b>			
8	<b>BS-102</b>	<b>ENGINEERING PHYSICS-II</b>	The objective of this course is to give an understanding of the basic knowledge and impart quality education in physical sciences to the budding engineers. To strengthen the skills in basic measurements by exposing the students to well-equipped labs and enhance the problem solving ability through interactive classes.
9	<b>BS-104</b>	<b>ENGINEERING MATHEMATICS-II</b>	The aim of the course is to solve the applications based on real industrial problems. Uncertainty is an essential feature of the engineering environment and for this reason the fields of probability and statistics are also included.
10	<b>ES-102</b>	<b>INTRODUCTION TO ENVIRONMENTAL SCIENCES</b>	This course will help students to develop an understanding of various environmental issues, Need for sustainable development, Solid waste disposal, Degradation of environment, Global warming, The depletion of ozone layer, Loss of biodiversity and various environmental laws.
11	<b>ES-104</b>	<b>INTRODUCTION TO CADD</b>	The objective of this course is to introduce the students about how computer help in industrial designing, Basics of computer graphics, knowledge about AutoCAD software.
12	<b>ES-106</b>	<b>BASICS OF ELECTRONICS ENGINEERING</b>	This course enables the students to understand the concept and behavior of passive electrical components in DC and AC circuits, Structure, Functionality and characteristics of electronic devices and their usage in designing Analog and digital circuits. It also describes some advanced applications and how electronic circuits can interact with outside world.

13	<b>ES-108</b>	<b>BASICS OF MECHANICAL ENGINEERING</b>	The main objective of the course is to understand and identify the problems related to mechanical engineering, Which may come across to the students, Irrespective of any branch of engineering during their career. In present industrial scenario engineers of every field are employed, Therefore the students of every branch must know the basic concepts of mechanical engineering.
14	<b>ELGA-102</b>	<b>ENGLISH LANGUAGE AND GENERAL AWARENESS-II</b>	The course aims at helping the students enhance their quality of English communication by developing an understanding of correct usage of words and phrases. It also helps them frame grammatically as well as logically correct sentences.
<b>THIRD SEMESTER</b>			
15	<b>EE-201</b>	<b>ELECTRICAL MACHINE -I</b>	To make the students understand the basic concepts of transformer operation, Their types, Parameters calculations, Energy conversion principles, DC machines fundamentals and its operation. After undergoing this course the students will have the knowledge of transformers, Energy conversion principles and DC machines operation.
16	<b>EE-203</b>	<b>ELECTRICAL CIRCUIT THEORY</b>	To make the students understand the basic concepts of circuits analysis, Their transient behaviour and theorems applications. After undergoing this course the students will have the knowledge of circuit analysis, Network theorems, Two port networks and coupled circuits etc.
17	<b>EE-205</b>	<b>ELECTRICAL MEASUREMENTS &amp; MEASURING INSTRUMENTS</b>	To make the students understand the basic concepts of measurements and instruments, Their operating principles, And applications After undergoing this course the students will have the knowledge of various measuring instruments, Their types, Measurements of various quantities, Applications etc.
18	<b>EE-207</b>	<b>POWER GENERATION</b>	To make the students understand the basic concepts of electrical power generation using hydro, Nuclear, Thermal, Non-conventional energy sources and their economic operation. After undergoing this course the students will have the knowledge of various power plants, Their economic operation, Tariff structure, And power

			factor improvement etc.
19	<b>EE-209</b>	ANALOG ELECTRONICS	To make the students understand the basic concepts of electronic devices and their engineering applications. After undergoing this course the students will have the knowledge of various amplifiers, OPAM circuits, Oscillators and wave shaping circuits etc.
20	<b>HS-201</b>	ESSENTIALS OF MANAGEMENT AND ORGANIZATIONAL BEHAVIOR	To help the students lay a foundation to an understanding of Management and Organizational behavior which are essential fields of study to make a success of both their professional and personal lives.
21	<b>ELGA-201</b>	ENGLISH LANGUAGE AND GENERAL AWARENESS-III	The course is designed to help students develop effective communication skills, and hence, it lays emphasis on their spoken and listening skills.
<b>FOURTH SEMESTER</b>			
22	<b>EE-202</b>	ELECTRICAL MACHINES-II	To make the students understand the basic concepts of synchronous generator, Motor, Induction motor, Single phase and three phase. After undergoing this course the students will have the knowledge of operation and analysis of AC machines, And their applications.
23	<b>EE-204</b>	TRANSMISSION AND DISTRIBUTION	To make the students understand the basic concepts of transmission and distribution systems. After undergoing this course the students will have the knowledge of transmission and distribution systems parameters calculations, Transmission system efficiency, Mechanical design of lines, Insulators, Their types, Corona and cables etc.
24	<b>EE-206</b>	SIGNAL AND SYSTEMS	To make the students understand the basic concepts of signals an systems, Fourier series representation. After undergoing this course the students will have the knowledge of linear time invariant systems, Fourier, Continuous time, And discrete transforms and their applications etc.
25	<b>EE-208</b>	POWER ELECTRONICS-I	To make the students understand the basic concepts of power semiconductor devices and their classifications. After undergoing this course the students will have the knowledge of various power semiconductor devices. Types, Classifications and their operation etc.
26	<b>EE-210</b>	DIGITAL	To make the students understand the

		ELECTRONICS	basic concepts of number systems, Logic gates, Sequential circuits and memories. After undergoing this course the students will have the knowledge of Boolean algebra, Logic gates, Sequential circuits, Memory and A/D and D/A converters etc.
27	HS-202	FUNDAMENTALS OF BUSINESS & ECONOMICS	To provide the students a basic understanding of Business and Economics which are vital constituents of the overall professional environment of an engineer.
28	ELGA-202	ENGLISH LANGUAGE AND GENERAL AWARENESS-IV	The course deals with clause analysis, sentence classification based on clauses, time and tense and common errors in sentence structure. The purpose is to familiarize students with all kinds of sentences and their use.
<b>FIFTH SEMESTER</b>			
29	EE-301	ELECTROMAGNETIC FIELD THEORY	To make the students understand the basic concepts of electromagnetic fields theory and their behaviour. After undergoing this course the students will have the knowledge of electrostatics, Magnetostatics, And waves and applications etc.
30	EE-303	NETWORK ANALYSIS AND SYNTHESIS	To make the students understand the basic concepts of network analysis and their synthesis. After undergoing this course the students will have the knowledge of circuit fundamentals and their solutions, Laplace transform, Synthesis and analysis of circuits, Transfer functions etc.
31	EE-305	CONTROL SYSTEMS-I	To make the students understand the basic concepts of control system theory and its engineering applications. After undergoing this course the students will have the knowledge of control system components, Time domain and frequency domain analysis of systems, Root locus techniques and Nyquist criterion etc.
32	EE-307	POWER ELECTRONICS-II	To make the students understand the basic concepts of converters, Their types, Characteristics and power supplies. After undergoing this course the students will have the knowledge of various converters, Their types, Characteristics, Classifications, Operation and applications etc.
33	EE-309	POWER SYTEMS ANALYSIS	To make the students understand the basic concepts of power systems

			analysis, Methods, And stability analysis. After undergoing this course the students will have the knowledge of per unit system, Symmetrical and unsymmetrical faults, Economic load dispatch, Stability studies etc.
34	<b>EE-311</b>	<b>MICRO-PROCESSORS-I</b>	To make the students understand the basic concepts of microprocessors, Architecture, Peripheral devices, Interfacing and types. After undergoing this course the students will have the knowledge of various microprocessors, Types, Architecture, Programming, Interfacing etc.
35	<b>ELGA-301</b>	<b>ENGLISH LANGUAGE AND GENERAL AWARENESS-V</b>	The course facilitates the learning of the principles of effective formal and business communication. The course is designed to familiarize students with the developments in the fields of science, defence, space, sports and cinema. The course will also help students in develop general mental ability
<b>SIXTH SEMESTER</b>			
36	<b>EE-302</b>	<b>SWITCHGEAR AND PROTECTION</b>	To make the students understand the basic concepts of relays, Protective devices, Circuit breakers fundamentals and protective schemes. After undergoing this course the students will have the knowledge of various protective devices, Their operation, CBs, Their types, Operating principles, Protective schemes, Applications etc.
37	<b>EE-304</b>	<b>COMPUTER METHODS IN POWER SYTEMS</b>	To make the students understand the basic concepts of computer techniques to solve power systems problems. After undergoing this course the students will have the knowledge of faults analysis, Load flow analysis using computer techniques etc.
38	<b>EE-306</b>	<b>ELECTRICAL MACHINE DESIGN</b>	To make the students understand the basic concepts of electricakl machine design. After undergoing this course the students will have the knowledge of design concepts of various types of electrical machines, Their design fundamentals etc.
39	<b>EE-308</b>	<b>CONTROL SYSTEMS-II</b>	To make the students understand the basic concepts of state variable approach, Non-linear systems, Transforms. After undergoing this course the students will have the knowledge of state variable approach

			for solutions, Second order systems, Applications of transforms to systems, And sampled data systems etc.
40	<b>EE-310</b>	ADVANCED MICROPROCESSOR & MICROCONTROLLER	To make the students understand the basic concepts of advanced microprocessors and microcontrollers. After undergoing this course the students will have the knowledge of 8086 architecture, Instruction sets, Microcontrollers, Applications etc.
41	<b>EE-312</b>	ADVANCED INSTRUMENTATION	To make the students understand the basic concepts of fluids and fluid flow which are essential in majority of the engineering applications. After undergoing this course the students will have the knowledge of various pressure measuring instruments, Fluid statics, Types of fluid motion, Fluid dynamics, Pipe flow, The concept of boundary layer, Lift and drag etc.
42	<b>EE-320</b>	SEMINAR	The student is required to deliver an independent seminar on any of emerging areas/ application of Electronics & Communication Engineering courses. Senior faculty will supervise the students in selecting and preparation of the same. The student will submit two copies of seminar report (at least one week prior to the presentation) and shall make oral presentation as per time schedule decided by the faculty concerned. Internal Evaluation will be made on the basis of report, Presentation and the discussion during the presentation.
43	<b>ELGA-302</b>	ENGLISH LANGUAGE AND GENERAL AWARENESS-VI	The purpose of the course is to make the students confident of using English in formal as well as informal communication for business and all other purposes. The purpose of the course is to provide information on the basic concepts of entrepreneurship, IT, and business infrastructure and related legal concepts. Besides, this course also aims at familiarizing student with energy technologies and functioning of human body.
<b>SEVENTH SEMESTER</b>			
44	<b>EE-421</b>	DEPARTMENTAL ELECTIVE-I POWER SYSTEM OPERATION AND CONTROL	To make the students understand the basic concepts power system operation and control. After undergoing this course the students will have the



			knowledge of AGC, ELD, Coordination equations, Hydrothermal scheduling and AVR etc.
45	<b>EE-422</b>	DEPARTMENTAL ELECTIVE-II HIGH VOLTAGE ENGINEERING	To make the students understand the basic concepts of breakdown phenomenon, Concepts of high voltage engineering. After undergoing this course the students will have the knowledge of breakdown phenomenon in gases, Liquids, Solids, Generation of DC/AC/impulse waves, Measurements etc.
46	<b>EE-423</b>	DEPARTMENTAL ELECTIVE-III POWER SYSTEM RESTRUCTURING AND POWER MANAGEMENT	To make the students understand the basic concepts of power system restructuring. After undergoing this course the students will have the knowledge of competition in electricity markets, Deregulation process in the world, And in India, Transmission pricing issues, Energy management etc.
47	<b>EE-424</b>	DEPARTMENTAL ELECTIVE-IV UTILIZATION OF ELECTRICAL ENERGY	To make the students understand the basic concepts of illumination, Lighting, Heating, Electrolytic process and utilization of energy by various methods. After undergoing this course the students will have the knowledge of illumination, Lighting, Heating, Electrolytic process, Electric traction etc.
48	<b>OE-431</b>	OPEN ELECTIVE-I ADVANCED ENGINEERING MATHEMATICS	The aim of the syllabus is to study the convergence behavior of various infinite series, To solve the applications based on double integral (surface integral) and triple integral (volume integral). The last unit 'functions of complex variables' has been added due to its usefulness in evaluating large number of new definite integrals, The theory of differential equations, The study of electric fields, Thermodynamics, And fluid mechanics.
49	<b>OE-432</b>	OPEN ELECTIVE-II ENTREPRENEURSHIP	After the completion of the course, the students will be able to have the ability to discern distinct entrepreneurial traits, Know the parameters to assess opportunities and constraints for new business ideas, Understand the systematic process to select and screen a business idea, design strategies for successful implementation of ideas, write a business plan.
<b>EIGHTH SEMESTER</b>			
51	<b>EE-441/442</b>	INDUSTRIAL	Each student is expected to undergo one

		TRAINING/PROJECT	complete semester of industrial/ field/ Lab training in order to connect the class room teaching with real time practical applications. A supervisor (faculty from the Department) shall be assigned to the student approved by the competent authority. The training and placement officer (TPO) will facilitate the students for the purpose with the consent of his/her supervisor and also considering the interests of the student. During training the student will undertake a project involving design/ experimental/ analytical/ computational work including case studies etc. The progress of the project work will be evaluated by the concerned supervisor and TPO by visiting the site/ industry/ lab etc.
52	EE-450	COMPREHENSIVE ACADEMIC AND GENERAL PROFICIENCY VIVA-VOCE	A viva-voce for every student for his/her academic and General Proficiency for the Profession shall be carried out by a committee comprising of three members including Principal/Director, Head of Department, and an External Examiner appointed by the University. The evaluation will be made in the light of various parameters including Academic Performance, Extra Curricular Activities, Educational tours / visits / Membership of Professional Societies, Contribution in NSS Social Welfare Floor Relief / draught relief / Adult Literacy mission / Literacy Mission / Blood Donation / any other Social Service, other achievements in the Institution and the performance in viva voce before the committee.

**[C] Programme Outcomes (POs) for M.Tech Power System and Renewable Energy:**

	Programme outcomes
PO1.	Gain broad education necessary to understand the impact of power system & renewable energy engineering solutions in a global, economic, environmental and societal context and enhance personal and professional growth.
PO2.	Acquire in-depth technical knowledge of power system & renewable energy engineering and be able to apply the same for enhancement of knowledge.

PO3.	Analyze complex power system engineering problems and be able to learn and use contemporary tools and technique for solving problems related to power system & renewable energy engineering and allied areas.
PO4.	Integrate knowledge and manage advanced and emerging problems in power system & renewable energy engineering and related areas.
PO5.	Conduct research plan, analyze and articulate research findings through writing and oral presentation.
PO6.	Design a system, component, or process to meet the desired needs with realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
PO7.	Function in multidisciplinary teams.
PO8.	Communicate effectively.
PO9.	Write clearly and to document own work for effective utilization.
PO10.	Extract knowledge through literature survey, experimentation, research, computing tools and techniques.
PO11.	Recognize the need and engage in life-long learning through independent study, projects and research.
PO12.	Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.
PO13.	Evaluate critically one's own action and work and make decisions by considering professional, social and ethical responsibilities

**[D] Course Outcomes (COs) for M.Tech Power System**

Sr. No.	Course Code	Course Title	Course Outcomes
<b>FIRST SEMESTER</b>			
1	PSE-411	ADVANCED POWER SYSTEM ANALYSIS	To make the students understand the Advanced Concept of Power System analysis, Topological Analysis of power Network and Bus impedance Algorithm. After undergoing this course the students will have the knowledge of per unit system, balanced and Unbalanced elements Symmetrical and unsymmetrical faults, load flow studies, Optimal power Flow Numerical Iteration Method and Power System Security studies etc.
2	PSE-412	POWER SYSTEM DYNAMICS & STABILITY	To make the students understand the Advanced Concept of Power System the dynamic mechanisms behind angle and voltage stability problems in electric power systems, including physical phenomena and modelling issues. After undergoing this course the students will have the knowledge of Synchronous machine modeling for stability, Modeling of Excitation and speed governing systems, Small signal stability & Voltage Stability of power systems studies etc.
3	PSE-413	POWER SYSTEM OPERATION & CONTROL	To make the students understand the Advanced Concept of Power System operation and control. After undergoing this course the students will have the knowledge of load forecasting, hydro-thermal scheduling, Economic Dispatch Problem unit commitment problem, Control of power system (Real & Reactive Power) and State Estimation of Power System studies etc.
4	PSE-414	POWER QUALITY	To make the students understand the Concept of power quality related problems and power quality terminologies. After undergoing this course the students will have the knowledge of the nonlinear load, Measurements and analysis method of voltage , current power power factor and methods for improvement of power studies etc.
5	PSE-511	ELECTIVE-I TRANSIENT IN POWER SYSTEMS	To Make the students will be able to understand the Simulation and analysis of transient in power System and mathematical modelling of various over

			voltages, and analyse different situations. After undergoing this course students will have the knowledge of various travelling waves on transmission line , very fast transient overvoltage (VFTO), Insulation Coordination in AIS & GIS and the Analysis of winding under transient Condition studies etc.
6	<b>PSE-512</b>	<b>ELECTIVE-II SYSTEMS THEORY</b>	To Make the students will be able to understand the basic fundamental of physical systems and its representation in terms of state variable, controllability and observability, state feedback control design for SISO & MIMO system, Stability analysis of nonlinear systems and its behaviour studies etc.
7	<b>PSE-513</b>	<b>ELECTIVE-III POWER SYSTEMS PLANNING</b>	To Make the students will be able to understand the basic concept of planning and building for more reliable power system. The scope of employability in power utilities will increase. The management skills required in the field of power system engineering is enhanced. After undergoing this course students will have the knowledge of Generation & Transmission system reliability Analysis, Expansion planning of transmission system and Distributed planning studies etc.
<b>SECOND SEMESTER</b>			
8	<b>PSE-421</b>	<b>EHV AC/DC TRANSMISSION</b>	To make the students understand the Advanced Concept of EHV AC/DC transmission system. After undergoing this course the students will have the knowledge of the line parameters and property of EHV AC transmission lines, effect of corona on EHV, Switching over voltage and reduction of switching surge on EHV system calculation of electrostatic field of AC lines and able to understand their effect on voltage gradients, Transmission of power through HVDC links, performance characteristics of 6 pulse circuits, firing angle control of HVDC, control characteristics in HVDC, harmonics in HVDC, protection of HVDC studies etc.
9	<b>PSE-422</b>	<b>POWER SYSTEM PROTECTION AND RELAYING</b>	To make the students understand the concept of various types of protection for Power System equipment and various types of relays. After undergoing this course the students will have the knowledge of differential Protection of Transformer, Generator Protection

			Scheme, Distance and carrier protection of transmission line, Differential Protection of bus-bar, numerical protection and Functionality of different types of static relays, microprocessor based relays and various types of overcurrent relays studies etc.
10	<b>PSE-423</b>	<b>FLEXIBLE AC TRANSMISSION SYSTEMS</b>	To make the students understand the basic concept for the analysis of real power, reactive power and power factor can be improved in power system using facts devices. After undergoing this course the student will have the knowledge different types of facts controller for control the reactive power in transmission line, Compensation method in power system, modelling & design Analysis the use of control scheme of SVS system, STATCOM, TCSC, SSSC and IPFC for improving the power flow, system dynamics and system stability studies etc.
11	<b>PSE-424</b>	<b>DISTRIBUTED POWER GENERATION</b>	To make the students understand the basic concept new renewable energy based electrical energy generation technology like as MHD, PV cell, and wind and their integrated power distribution grid. After undergoing this course the students will have the construction and working knowledge of different types of fuel cell, MHD generation, PV cell, wind turbine, hydroelectric, biofuel and geothermal. Basic performance parameter of renewable energy such as efficiency and cost. Design and analysis of wind-diesel system, wind-solar system are integrated to distributed power system studies etc.
12	<b>PSE-521</b>	<b>ELECTIVE-I POWER APPARATUS AND MACHINES</b>	To make the students understand the basic elements of generalized theory of electrical DC/AC machines & Transformer and also derive the general equations for voltage and torque of all type of rotating machines. After undergoing this course the student will have the knowledge the effect of slip power, harmonics on induction motor, reactance and time constants-Primitive machine model of synchronous machine, working of various types of special machine like as servo, stepper, reluctance and brushless DC motor, Modelling and analysis of Synchronous & Induction motor, design of transformer as mutually coupled and multi circuit transformer studies etc.

13	<b>PSE-522</b>	ELECTIVE-II ADVANCED ELECTRICAL DRIVES	To make the students understand the basic concept of converter topologies and control principles used in modern electrical motor drives. Electrical drives play an important role in transportation, materials handling and most production processes. After undergoing this course the student will have the knowledge of DC motor drive, Chopper Controlled DC motor drive, equivalent circuit and steady state performance equation of 3-phase induction motor, dynamic modelling of induction machine 3-phase to 2-phase transformation, design of phase controlled induction motor and vector induction motor drive are used for control the stator voltage, stator frequency, air gap flux, harmonics, phase shifting and direct vector, indirect vector, direct torque respectively studies etc.
14	<b>PSE-523</b>	ELECTIVE-III POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS	To make the students understand the design and analysis of grid & off grid connected power electronic converters with different renewable energy system like as solar, wind, ocean, fuel cell, biomass, hydrogen energy & hybrid system. After undergoing this course the student will have the knowledge of basic principle of operation and analysis of various types of electrical machines like as IG, PMSG, SCIG and DFIG for electrical energy conversion. Analysis of Grid integrated PMSG and SCIG Based WECS-Grid Integrated solar system. Design of MPPT for wind turbines and PV solar systems to maximize power extraction under all conditions studies etc.
<b>THIRD SEMESTER</b>			
15	<b>PSE-431</b>	SPECIAL TOPICS IN POWER SYSTEM	To make the students understand the basic concepts of power system restructuring & Deregulation, various optimization techniques for power system, SCADA & Automation system. After undergoing this course the students will have the knowledge of competition in electricity markets, Deregulation process in the world, and in India, Transmission pricing issues, Availability of jobs in power companies at managerial level in distribution, transmission and generation sector, Energy management studies etc.
16	<b>PSE-432</b>	WIND ENERGY CONVERSION SYSTEMS	To make the students understand the basic components of wind energy conversion system and control the wind power. After

			undergoing this course the students will have the knowledge the design of wind turbine (HAWT & VAWT), Design of fixed and variable speed wind turbine, modelling the grid connected WECS system studies etc.
17	<b>PSE - 433</b>	SEMINAR	The student is required to deliver a seminar on some emerging topics of concern Engineering. Senior faculty will supervise the students in selecting and preparation of the same. The student will submit one copy of seminar report and shall make oral presentation as per time schedule decided by the faculty concerned. Internal Evaluation will be made on the basis of report, presentation and the discussion during the presentation.
18	<b>PSE- 434</b>	MINOR PROJECT	The student is required to deliver a seminar on some emerging topics of concern Engineering. Senior faculty will supervise the students in selecting and preparation of the same. The student will submit one copy of Minor project seminar report spiral binding and shall make oral presentation as per time schedule decided by the faculty concerned. Internal Evaluation will be made on the basis of report, presentation and the discussion during the presentation.
<b>FOURTH SEMESTER</b>			
19	<b>PSE - 441</b>	Dissertation	The primary objective of this course is to enhance the student ability to analyze and carry out independent investigations etc. Each student will carry out independent work which should involve creativity, innovation and ingenuity. A dissertation supervisor (s) having at least post-graduate qualification, having minimum three experience after post-graduation and published papers in international journal of repute in his/her credentials OR Doctorate degree with published papers in international journal of repute in his/her credentials, may be from industry/research organization shall be assigned to the student approved by the competent authority. <i>In no case, the candidate can have more than two dissertation supervisors.</i> Dissertation work shall comprise of literature survey, problem formulation, methodology used, S/W, H/W tools used, Results and discussion followed by the conclusions & further scope of work in that area.



			Industry oriented projects may be encouraged for the purpose. Finally, student must have published at least one international paper before submission of dissertation.
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**[E] Course Outcomes (COs) for M.Tech Renewable Energy:**

Sr. No.	Course Code	Course Title	Course Outcomes
<b>First Semester</b>			
1	RE-411	ENERGY ECONOMICS: THEORY AND PRACTICE	To make the students understand the basic concepts of energy economics, standard economic tools can be used to analyse energy-related policy issues and the analysis of specific energy issues in India. After undergoing this course the student will have the knowledge of commercial & non-commercial energy source, Cost & demand analysis of energy in market, financial & economic of energy technology, investing in energy projects, energy planning & policy making in India studies etc.
2	RE-412	FLUID MECHANICS & TURBO MACHINERY	To make the students understand the basic concepts of fluid mechanics, Application of fluid systems, principle operation and construction of turbo machine. After undergoing this course the student will have, the knowledge of fluid flow through pipes, differential analysis of fluid flow, flue flow over bodies, Compressible flow, and the principle, operation, construction & functioning of turbo machines studies etc.
3	RE-413	POWER SYSTEM ENGINEERING	To make the students understand the basic concepts of generation, Transmission and distribution of electricity, various types of load, operation and their control of power system. After undergoing this course the student will have the knowledge the working and operation of various method of power generation. Construction, working and principle operation of synchronous machine & transformer. Methods of power flow analysis & AGC for operation/control of power system
4	RE-414	RENEWABLE ENERGY RESOURCE CHARACTERISTICS & CONSERVATION TECHNOLOGIES	To make the students understand the basic concepts of solar photovoltaic system, solar-thermal energy conversion systems and bio-chemical energy conversion technology. To facilitate development of skills to formulate waste to energy

			appropriate technologies in industrial applications. After undergoing this course the student will have the knowledge of working, characteristic, conversion efficiency, Testing, standardization and evaluation of solar cell. Design and modelling of PV solar system and its application. Design of Solar collectors Energy Storage Utilization Systems for solar thermal system. designs of different biogas plants, various types of bio reactor & bio liquid fuel studies etc.
5	<b>RE-511</b>	<b>ELECTIVE-I WIND POWER GENERATION</b>	To make the students understand the basic concept of design & performance analysis of horizontal & vertical axis wind machine, site selection for increasing the efficiency of wind power plant and foundation, erection & Commissioning for set up the project of wind power plant & connected to the grid with electrical transmission line. After undergoing this course the student will have the knowledge of wind power project planning & structure, calculation for power curve measurement. Various mathematical & programming methods for implementations & quality assurance in the wind power project, operation & Maintenance management of wind plant studies etc.
6	<b>RE-512</b>	<b>ELECTIVE-II RENEWABLE ENERGY AND FOSSIL FUELS BASED THERMAL POWER GENERATION</b>	To make the students understand the basic concept of electrical energy generated by burning the fossil fuels and producing the steam. This steam is used to driven the steam turbine and Rankine, Brayton and Combined Cycle concepts for efficiency improvement through steam reheating. After undergoing this course the student will have the knowledge of design the fossil fuel and biomass fired boilers, steam generation through solar, geothermal and ocean resources, water system in thermal, evaluation of thermal efficiency of boiler, evaluation of heat rate of turbine and cogeneration system of steam-gas turbine studies etc.
7	<b>RE-513</b>	<b>ELECTIVE-III STATISTICS FOR ENGINEERS</b>	To make the students understand the basic concept of statistics for identify, formulates, and solves engineering problems. After undergoing this course the student will have the knowledge of basic concept of data representation & sampling, probability & Non- probability theory, hypothesis testing, curve fitting,

			correlation analysis and use the techniques, skills, and modern engineering tools necessary for engineering practice studies etc.
<b>SECOND SEMESTER</b>			
8	<b>RE-421</b>	<b>APPLIED MATHEMATICS FOR THERMAL ENGINEERS</b>	To make the students understand the basic concept the application of Fourier transform for solving heat conduction problems in infinite and semi-infinite rod, calculus of variation solving for vibrational problems in power plant, conformal mapping & application for solving the Fluid flow and heat flow problems., and finite difference method for solving parabolic, elliptic equations. These all methods are used for solving thermal engineering problems.
9	<b>RE-422</b>	<b>ENERGY POLICIES FOR SUSTAINABLE DEVELOPMENT</b>	To make the students understand the basic concept of Central and State policies on the consumption and wastage of energy, latest development in climate change policies and energy conversion scheme. After undergoing this course the student will have the knowledge of critical analysis of renewable energy policies, green-house effect, environment laws, energy audit, energy management, energy planning and energy policies studies etc.
10	<b>RE-423</b>	<b>RENEWABLE ENERGY SYSTEMS</b>	To make the students understand the basic concept of renewable energy sources like as solar, wind, bio, hydrogen, fuel ocean and geothermal and relevant technologies towards their effective utilization for meeting energy demand. After undergoing this course the student will have the knowledge of construction, working, principal operation and energy conversion system studies etc.
11	<b>RE-424</b>	<b>COMPUTATIONAL FLUID DYNAMICS</b>	To make the students understand the basic concept of computational fluid dynamics to engineering flow problems and both flow physics and mathematical properties of governing Navier-Stokes equations and define proper boundary conditions for solution. Use CFD software to model relevant engineering flow problems. Analyse the CFD results. Compare with available data, and discuss the findings. After undergoing this course the student will have the knowledge of Governing equations, partial differential equations, hyperbolic equations, parabolic equations, elliptical equations of CFD, finite volume method for one, two, three dimensional

			diffusion problem studies etc.
12	<b>RE-521</b>	ELECTIVE-I ADVANCED ENERGY CONVERSION SYSTEMS	To make the students understand the advanced concept of energy conversion system for increasing the growth rate of energy by fossil fuel, nuclear fuels and solar energy resources in India. After undergoing this course the student will have the knowledge of design & operation of thermal plant, design, operation & performance analysis of STAG, analysis of chemical & nuclear equation for design the nuclear power plant studies etc.
13	<b>RE-522</b>	ELECTIVE-II HYDROPOWER SYSTEMS	To make the students understand the concept of Design analysis & mathematical modelling of turbine ( Pelton, Francis and Kaplan turbines), overview of hydropower, Analysis of Hydropower plant, turbine-governing system
14	<b>RE-523</b>	ELECTIVE-III ADVANCED SOLAR THERMAL AND PV SYSTEMS	To make the students understand the basic concept of solar power generation from PV panels and thermal systems. After undergoing this course the student will have the knowledge of different cell technologies, various solar collector & its performance analysis, solar thermal power system, design & performance analysis of PV cell, life cycle & evaluation carbon credit of solar energy system studies etc.
<b>THIRD SEMESTER</b>			
15	<b>RE-431</b>	ENERGY MODELING, ECONOMICS AND PROJECT MANAGEMENT	To make the students understand the basic concept of energy modeling approaches, econometrics & statistical used for economic energy analysis and forecasting in India, and Project Evaluation & Management. After undergoing this course the student will have the knowledge of energy demand analysis & forecasting, cost analysis, waste heat recovery, cogeneration, energy conversion, regression model, Interfuel substitution models, SIMA model, and I-O model for energy policy analysis, PERT, CPM, CERT, Fuzzy logic analysis, Stochastic based formulations for project evaluation & management Studies etc.
16	<b>RE-432</b>	DESIGN AND ANALYSIS OF ENERGY SYSTEM	To make the students understand the basic concept of design and analysis of energy system. After undergoing this course the student will have the knowledge design of heat exchanger, cooling tower, pressure drop, pumping tower, pump system operation, pump characteristics simulation of a gas turbine system, mathematical

			modeling of thermodynamic studies etc.
17	<b>RE - 433</b>	SEMINAR	The student is required to deliver a seminar on some emerging topics of concern Engineering. Senior faculty will supervise the students in selecting and preparation of the same. The student will submit one copy of seminar report and shall make oral presentation as per time schedule decided by the faculty concerned. Internal Evaluation will be made on the basis of report, presentation and the discussion during the presentation.
18	<b>RE- 434</b>	MINOR PROJECT	The student is required to deliver a seminar on some emerging topics of concern Engineering. Senior faculty will supervise the students in selecting and preparation of the same. The student will submit one copy of Minor project seminar report spiral binding and shall make oral presentation as per time schedule decided by the faculty concerned. Internal Evaluation will be made on the basis of report, presentation and the discussion during the presentation.
<b>FOURTH SEMESTER</b>			
19	<b>RE - 441</b>	DISSERTATION	The primary objective of this course is to enhance the student ability to analyze and carry out independent investigations etc. Each student will carry out independent work which should involve creativity, innovation and ingenuity. A dissertation supervisor (s) having at least post-graduate qualification, having minimum three experience after post-graduation and published papers in international journal of repute in his/her credentials OR Doctorate degree with published papers in international journal of repute in his/her credentials, may be from industry/research organization shall be assigned to the student approved by the competent authority. <i>In no case, the candidate can have more than two dissertation supervisors.</i> Dissertation work shall comprise of literature survey, problem formulation, methodology used, S/W, H/W tools used, Results and discussion followed by the conclusions & further scope of work in that area. Industry oriented projects may be encouraged for the purpose. Finally, student must have published at least one international paper before submission of dissertation.

