DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

LIST OF COURSES OFFERED FOR MINOR PROGRAM (R20)

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course Title</th>
<th>Contact hours/week</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>20EEM1</td>
<td>Electrical Circuits</td>
<td>L 4 T 0 P 0 Total 4</td>
<td>4</td>
</tr>
<tr>
<td>20EEM2</td>
<td>Electrical Machines</td>
<td>L 4 T 0 P 0 Total 4</td>
<td>4</td>
</tr>
<tr>
<td>20EEM3</td>
<td>Electrical, Electronic Measurements and Instrumentation</td>
<td>L 4 T 0 P 0 Total 4</td>
<td>4</td>
</tr>
<tr>
<td>20EEM4</td>
<td>Elements of Power Engineering</td>
<td>L 4 T 0 P 0 Total 4</td>
<td>4</td>
</tr>
<tr>
<td>20EEM5</td>
<td>Essentials of Power Electronics</td>
<td>L 4 T 0 P 0 Total 4</td>
<td>4</td>
</tr>
<tr>
<td>20EEM6</td>
<td>Renewable Energy Technologies</td>
<td>L 4 T 0 P 0 Total 4</td>
<td>4</td>
</tr>
<tr>
<td>20EEM7</td>
<td>Energy Auditing</td>
<td>L 4 T 0 P 0 Total 4</td>
<td>4</td>
</tr>
</tbody>
</table>
Pre-requisites: Applied Physics

Course Educational Objective: This course introduces the basics of circuit concepts, electrical parameters, single phase AC circuits, magnetic circuits, resonance, network topology and network theorems

Course Outcomes: At the end of the course, the student will be able to:

CO1: Apply network reduction techniques to simplify electrical circuits. (Apply-L3)
CO2: Analyze electrical circuits using theorems. (Apply-L3)
CO3: Examine the performance of single phase AC circuits. (Apply-L3)
CO4: Understand the locus diagrams and magnetic circuits. (Understand-L2)
CO5: Evaluate the two-port network parameters. (Apply-L3)

UNIT – I: INTRODUCTION TO ELECTRICAL CIRCUITS
Circuit Concept, R-L-C Parameters, Voltage and Current Sources, Independent and Dependent Sources, Source Transformation, Voltage – Current relationship for Passive Elements (for different input signals –Square, Ramp, Saw tooth and Triangular). Kirchhoff’s Laws, Nodal Analysis, Mesh Analysis, Star–to-Delta or Delta-to-Star Transformations

UNIT – II: NETWORK THEOREMS
Superposition, Reciprocity, Thevinin’s, Norton’s, Maximum Power Transfer, Milliman’s and Compensation theorems for D.C excitations.

UNIT – III: SINGLE PHASE A.C. CIRCUITS
R.M.S. and Average values and form factor for different periodic wave forms, Steady State Analysis of R, L and C (in Series, Parallel and Series Parallel Combinations) with Sinusoidal Excitation, Concept of Reactance, Impedance, Susceptance and Admittance, Phase and Phase difference, Concept of Power Factor, Real and Reactive powers

UNIT – IV: LOCUS DIAGRAMS, RESONANCE AND MAGNETIC CIRCUITS

UNIT – V: TWO PORT NETWORKS
Two port networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters

TEXT BOOKS:
REFERENCE :


Pre-requisites: Applied Physics, Electrical circuits

Course Educational Objective: This course enables the student to learn the principle, construction and performance characteristics of DC and AC Machines. It also deals with principle and constructional features of transformers.

Course Outcomes: At the end of the course, the students will be able to

CO1: Analyze the performance of DC Machines. (Understand-L2)
CO2: Understand the operation of transformer. (Understand-L2)
CO3: Analyze the performance of induction and synchronous machines. (Understand-L2)
CO4: Understand the operation of special electrical machines. (Understand-L2)

UNIT I: DC MACHINES


UNIT II: SINGLE PHASE TRANSFORMERS & TESTING

Single phase transformers-types - constructional details- EMF equation- operation on no-load and on load - phasor diagrams- Equivalent circuit - losses and efficiency-regulation-OC and SC tests

UNIT III: INDUCTION MOTOR

Three-phase Induction motors-construction details-Production of a rotating magnetic field - principle of operation - rotor emf and rotor frequency - rotor reactance, rotor current and power factor- equivalent circuit-torque-slip characteristics

UNIT-IV: SYNCHRONOUS GENERATORS

Synchronous generator – construction, working principle- emf equation–types of rotors—phasor diagrams-regulation methods – EMF, MMF methods – Applications

UNIT-V: SPECIAL ELECTRICAL MACHINES

Principle of operation and construction of ac servo motors-speed-torque characteristics, BLDC motor- Principle of operation and construction-Applications, stepper motor- Principle of operation and construction-Applications

TEXT BOOKS:

REFERENCE:

Pre-requisites: Applied Physics

Course Educational Objective: This course enables the students to understand the construction and working principle of different types of meters. It also deals with different types of digital voltmeters and transducers.

Course Outcomes: At the end of the course student will able to:

CO1: Analyze the performance of AC and DC measuring instruments. (Understand-L2)

CO2: Determine the circuit parameters using AC and DC bridges. (Apply-L3)

CO3: Understand working principle of various types of digital meters. (Understand-L2)

CO4: Select appropriate transducers for measurement of physical phenomenon. (Apply-L3)

UNIT – I: INTRODUCTION TO MEASURING INSTRUMENTS

Errors in measurement, Classification, deflecting, control and damping torques, ammeters and voltmeters – PMMC, moving iron type instruments, shunts and multipliers. Construction and principle of operation of A.C (polar and coordinate type), D.C. Potentiometer (only Crompton’s type) standardization & its applications.

UNIT – II: DC & AC BRIDGES


UNIT – III: MEASUREMENT OF POWER AND ENERGY


UNIT-IV: DIGITAL METERS

Digital voltmeters – Successive approximation- ramp- dual slope integration - continuous balance type – Micro processor based ramp type DVM, digital frequency meter.

UNIT-V: TRANSDUCERS

Classification of transducers, advantages of electrical transducers, Characteristics and choice of transducers; Principle operation of LVDT and capacitor transducers; Strain gauge and its principle of operation, gauge factor, Thermistors, Piezo electric transducers.

TEXT BOOKS:

REFERENCE:

Prerequisite: Applied Physics, Basic Electric and Electronics Engineering

Course Educational Objective: This course deals with generation, transmission, and utilization of electric power and allied accessories like generators, motors and transformers.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand the basic concepts of electrical power engineering. (Understand-L2)
CO2: Develop a comprehensive working knowledge of the synchronous machines and transformer. (Understand-L2)
CO3: Identify various technologies available for electric power transmission and distribution. (Understand-L2)
CO4: Identify various utilization methods of electrical energy. (Understand-L2)

UNIT-I: INTRODUCTION
A brief history of electric power systems, the structure of the power system, concepts of power in alternating current systems-single line diagram of power Systems, Electromagnetism and Electromechanical Energy Conversion, sources of energy, comparison of energies, growth of power systems in India

UNIT-II: SYNCHRONOUS MACHINE & ELECTRIC POWER GENERATION

UNIT-III: ELECTRIC POWER TRANSMISSION

UNIT-IV: DISTRIBUTION OF ELECTRIC POWER
Introduction- Classification of distribution systems, characteristics of distribution systems, Elementary concepts of AC and DC power Distribution systems, voltage regulation and substation location.

UNIT-V: UTILIZATION OF ELECTRICAL ENERGY

TEXT BOOKS

REFERENCES
Prerequisite: Applied Physics, Basic Electric and Electronics Engineering

Course Educational Objective: This course deals with the basic theory of power semiconductor devices and their characteristics. It also deals with operating principles of rectifiers, AC voltage controllers, DC to DC converters and inverters.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand the operation of various power semiconductor devices. (Understand-L2)
CO2: Analyze the performance of rectifiers with and without filters. (Apply-L3)
CO3: Understand the operation of ac voltage controller with different loads. (Understand-L2)
CO4: Analyze the performance of various dc–dc converter topologies (Apply-L3)
CO5: Analyze the performance of inverters with different modulation techniques. (Apply-L3)

UNIT – I: POWER SEMI-CONDUCTOR DEVICES
Basic symbol, operation and characteristics of different power semiconductor devices - BJT, MOSFET, IGBT, SCR, GTO, DIAC and TRIAC.

UNIT – II: RECTIFIERS AND FILTERS
Half wave rectifier, Full wave rectifier, Bridge rectifier, Ripple factor Harmonic components in a rectifier circuit, Inductor filter, Capacitor filter, L-section filter, π-section filter, Multiple L-section and Multiple π section filter, and comparison of various filter circuits in terms of ripple factors, basics of regulators, single-phase Controlled rectifier with R and RL loads.

UNIT – III: AC VOLTAGE CONTROLLERS
AC voltage controllers—single phase ac voltage controller with R and RL loads for both half wave and full wave—continuous and discontinuous modes

UNIT – IV: DC TO DC CONVERTERS
Principle of operation-Control Strategies, Step-up and step-down chopper—Chopper classification- class A, B, C, D, E

UNIT – V: INVERTERS
Single phase inverter—Voltage Source Inverter (VSI)-Current source inverters (CSI) - Comparison between VSI and CSI- Single Pulse Width Modulation, Multiple Pulse Width Modulation, Sinusoidal Pulse Width Modulation.

TEXT BOOKS:

REFERENCE:
Pre-requisites: Applied Physics, Applied Chemistry

Course Educational Objective: This course enables the student to understand and analyze various renewable energy technologies.

Course Outcomes: At the end of the course student will able to:

CO1: Understand the principles of renewable energy. *(Understand-L2)*
CO2: Analyze the basic physics of solar and wind power generation. *(Understand-L2)*
CO3: Appreciate the ecological context of bio-energy. *(Understand-L2)*
CO4: Evaluate the performance of fuel cells under different operating conditions for a given application. *(Understand-L2)*

UNIT–I: PRINCIPLES OF RENEWABLE ENERGY
Introduction, energy and sustainable development, fundamentals, scientific principles of renewable energy. Technical implications.

UNIT–II: THE SOLAR RESOURCE

UNIT–III: PHYSICS OF WIND POWER

UNIT–IV: INTRODUCTION TO BIOMASS

UNIT–V: INTRODUCTION TO FUEL CELLS

TEXT BOOKS:

REFERENCE:
Pre-requisite course: Applied Physics, Basics of Electrical & Electronics Engineering.

COURSE OBJECTIVES: This course enables the student to learn principles of energy audit and Energy conservation act. It also covers energy efficient lighting design, power factor improvement techniques, energy efficiency in HVAC systems. In addition, economic aspects such as payback period calculations, life cycle costing analysis is covered in this course.

COURSE OUTCOMES: At the end of the course, the student will be able to:
CO1: Understand the different parameters for energy auditing. (Understand-L2)
CO2: Interpret the controlling of energy management. (Understand-L2)
CO3: Analyze the Reactive power management strategies. (Apply-L3)
CO4: Understand the energy conservation measures in HVAC systems. (Understand-L2)
CO5: Analyze economic aspects for energy conservation. (Apply-L3)

UNIT-I: BASIC PRINCIPLES OF ENERGY AUDIT
Energy audit- definitions, types of audit, energy index, cost index ,pie charts, Sankey diagrams, load profiles, Energy conservation schemes- Energy audit of industries- energy saving potential, energy audit in process industry viz., thermal power station, energy audit in buildings, Smart Metering and its implementation.

UNIT-II: ENERGY MANAGEMENT
Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting- Energy manger, Qualities and functions.

UNIT-III: POWER FACTOR IMPROVEMENT, LIGHTING AND ENERGY INSTRUMENTS
Power factor –Pf with non linear loads, effect of harmonics on power factor, power factor motor controllers - Good lighting system design and practice, lighting control ,lighting energy audit – List of Instruments for energy audit- wattmeter, data loggers, thermocouples, pyrometers, lux meters, tongue testers

UNIT-IV: SPACE HEATING AND VENTILATION

UNIT-V: ECONOMIC ASPECTS AND ANALYSIS
Economics Analysis-Depreciation Methods, time value of money, rate of return, present worth method- CASE STUDY- Energy efficient motors, replacement analysis, life cycle costing analysis- calculation of simple payback method, CASE STUDY, Power factor correction, lighting - Applications of life cycle costing analysis, return on investment.

TEXT BOOKS:

REFERENCE: