ELECTRICAL AND ELECTRONICS ENGINEERING
<table>
<thead>
<tr>
<th>Sub. Code</th>
<th>Subject Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>14EE1001</td>
<td>Basic Electrical Engineering</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE2001</td>
<td>Electric Circuits and Networks</td>
<td>3:1:0</td>
</tr>
<tr>
<td>14EE2002</td>
<td>Electric Circuit Analysis</td>
<td>3:1:0</td>
</tr>
<tr>
<td>14EE2003</td>
<td>Network Analysis and Synthesis</td>
<td>3:1:0</td>
</tr>
<tr>
<td>14EE2004</td>
<td>Electromagnetic Fields</td>
<td>3:1:0</td>
</tr>
<tr>
<td>14EE2005</td>
<td>DC Machines and Transformers</td>
<td>3:1:0</td>
</tr>
<tr>
<td>14EE2006</td>
<td>DC Machines and Transformers Laboratory</td>
<td>0:0:2</td>
</tr>
<tr>
<td>14EE2007</td>
<td>Induction and Synchronous Machines</td>
<td>3:1:0</td>
</tr>
<tr>
<td>14EE2008</td>
<td>AC Machines and Controls Laboratory</td>
<td>0:0:2</td>
</tr>
<tr>
<td>14EE2009</td>
<td>Electrical Machine Design</td>
<td>3:1:0</td>
</tr>
<tr>
<td>14EE2010</td>
<td>Power Electronics</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE2011</td>
<td>Power Electronics Laboratory</td>
<td>0:0:2</td>
</tr>
<tr>
<td>14EE2012</td>
<td>Electric Drives and Control</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE2013</td>
<td>Transmission and Distribution</td>
<td>3:1:0</td>
</tr>
<tr>
<td>14EE2014</td>
<td>Power System Analysis</td>
<td>3:1:0</td>
</tr>
<tr>
<td>14EE2015</td>
<td>Computer Aided Power System Analysis Laboratory</td>
<td>0:0:2</td>
</tr>
<tr>
<td>14EE2016</td>
<td>Power System Protection and Switchgear</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE2017</td>
<td>Linear, Digital IC and Measurements Laboratory</td>
<td>0:0:2</td>
</tr>
<tr>
<td>14EE2018</td>
<td>Energy Systems</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE2019</td>
<td>Special Electrical Machines</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE2020</td>
<td>Automotive Electronics</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE2021</td>
<td>Illumination Engineering</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE2022</td>
<td>Power System Stability</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE2023</td>
<td>Power System Operation and Control</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE2024</td>
<td>Basics of Electric and Hybrid Vehicle</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE2025</td>
<td>Fundamentals of Electrical Safety</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE2026</td>
<td>High Voltage Engineering</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE2027</td>
<td>HVDC and FACTS</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE2028</td>
<td>Building Automation</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE2029</td>
<td>Design Laboratory</td>
<td>0:0:1</td>
</tr>
<tr>
<td>14EE2030</td>
<td>Power System Simulation Laboratory</td>
<td>0:0:2</td>
</tr>
<tr>
<td>14EE2031</td>
<td>Renewable Energy – I</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE2032</td>
<td>Renewable Energy – II</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE2033</td>
<td>Harmonics and Power Quality</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE2034</td>
<td>Power System Reliability</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE2035</td>
<td>Switched Mode Power Supplies</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE2036</td>
<td>Smart Grid</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE2037</td>
<td>Computer Aided Graphics for Electrical Engineers</td>
<td>0:0:2</td>
</tr>
<tr>
<td>14EE2038</td>
<td>Advanced Topics in Power Electronics</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3001</td>
<td>Power Semiconductor Devices</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3002</td>
<td>Power Converter Analysis – I</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3003</td>
<td>Power Converter Analysis – II</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3004</td>
<td>Solid State DC Drives</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3005</td>
<td>Solid State AC Drives</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3006</td>
<td>Waste To Energy Conversion</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3007</td>
<td>Generalized Theory of Electrical Machines</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3008</td>
<td>Special Machines and Controllers</td>
<td>3:0:0</td>
</tr>
</tbody>
</table>

LIST OF SUBJECTS

2014 | Department of Electrical and Electronics Engineering
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>14EE3009</td>
<td>Power Electronics Laboratory</td>
<td>0:0:1</td>
</tr>
<tr>
<td>14EE3010</td>
<td>Electric Drives and Control Laboratory</td>
<td>0:0:1</td>
</tr>
<tr>
<td>14EE3011</td>
<td>Photovoltaic Systems</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3012</td>
<td>Power Electronic Circuits</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3013</td>
<td>Energy Engineering</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3014</td>
<td>Wind Energy</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3015</td>
<td>Hydrogen and Fuel Cells</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3016</td>
<td>Energy Management and Audit</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3017</td>
<td>Energy Modeling, Economics and Project Management</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3018</td>
<td>Solar Energy Laboratory</td>
<td>0:0:1</td>
</tr>
<tr>
<td>14EE3019</td>
<td>Wind Energy Laboratory</td>
<td>0:0:1</td>
</tr>
<tr>
<td>14EE3020</td>
<td>Power Engineering Simulation Laboratory</td>
<td>0:0:1</td>
</tr>
<tr>
<td>14EE3021</td>
<td>Flexible AC Transmission Systems</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3022</td>
<td>HVDC Transmission</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3023</td>
<td>Industrial Power System Analysis and Design</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3024</td>
<td>Distributed Generation</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3025</td>
<td>Communications And Control in Smart Grid</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3026</td>
<td>Electrical Transients in Power Systems</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3027</td>
<td>EHV Power Transmission</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3028</td>
<td>Power System Planning And Reliability</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3029</td>
<td>Electric and Hybrid Vehicles</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3030</td>
<td>Modelling and Design of Electric and Hybrid Vehicle</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3031</td>
<td>Power Management For HEV</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3032</td>
<td>Hybrid-Electric Vehicle Powertrains</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3033</td>
<td>Vehicle Energy Storage Systems</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3034</td>
<td>Electric Vehicle Battery Technology</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3035</td>
<td>Modeling of Power Converters</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3036</td>
<td>Power Electronics in Wind and Solar Power Conversion</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3037</td>
<td>DSP Based Control of Power Electronics and Drives</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3038</td>
<td>Power Quality</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3039</td>
<td>Tidal Energy</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3040</td>
<td>Simulation of Power Electronic Systems</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3041</td>
<td>Power Electronics Applications to Power System</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3042</td>
<td>Neuro-Fuzzy Controller for Electric Drives</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3043</td>
<td>Advanced Control Techniques for Induction Generators</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3044</td>
<td>Optimal Control of Wind Energy Systems</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3045</td>
<td>Wind Resource Assessment and Forecasting Methods</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3046</td>
<td>Turbines for Renewable Energy System</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3047</td>
<td>Data Mining for Renewable Energy Technologies</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3048</td>
<td>Grid Converters for Wind Power Systems</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3049</td>
<td>Offshore Wind Power</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3050</td>
<td>Wind Power in Power Systems</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3051</td>
<td>Solar Cell and Module Technology</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3052</td>
<td>PV System Design and Installation</td>
<td>3:0:0</td>
</tr>
<tr>
<td>14EE3053</td>
<td>Materials for Solar Power</td>
<td>3:0:0</td>
</tr>
</tbody>
</table>
14EE1001 BASIC ELECTRICAL ENGINEERING

Credits: 3:0:0

Course Objective
- To impart the basic knowledge about the Electric and Magnetic circuits.
- To understand the working of various Electrical Machines.
- To know about various measuring instruments and house wiring.

Course Outcome
- Predicting the behavior of any electrical and magnetic circuits.
- Identifying the type of electrical machine used for a particular application.
- Wiring any circuit depending upon the requirement.

Description

Reference Books
14EE2001 ELECTRIC CIRCUITS AND NETWORKS

Credits 3:1:0

Corequisite: 14MA2003 Mathematical Transforms
14MA2004 Laplace Transforms, Fourier series and Transforms

Course Objective
• To develop the ability to apply the basic laws and theorems to analyze a DC and AC electric circuit.
• To use mathematical methods such as Laplace transform and some linear algebra techniques and differential equations to solve circuits problems.
• To analyze three phase circuits

Course Outcome
The student will be able to
• Analyze simple circuits applying Ohm’s and Kirchhoff’s laws
• Analyze first-order response of RL, RC and RLC circuits.
• Design any non linear network, filters and attenuators for an application

Description

Reference Books

14EE2002 ELECTRIC CIRCUIT ANALYSIS

Credits 3:1:0

Corequisite: 14MA2003 Mathematical Transforms
14MA2004 Laplace Transforms, Fourier series and Transforms

Course objective
• To develop the ability to apply the basic laws and theorems to analyze a DC and AC electric circuit.
• To use mathematical methods such as Laplace transform, linear algebra techniques and differential equations to solve circuits problems.

Course outcome
The student will be able to
• Apply techniques for the analysis and simulation of linear electric circuits.
• Understand resistive and energy storage elements, controlled sources and transforms
• Analyze the transient and steady state behavior of a circuit using the S-plane representation.
**Description**

**Reference Books**

14EE2003 NETWORK ANALYSIS AND SYNTHESIS

**Credits** 3:1:0

**Pre requisite:** 14MA2003 Mathematical Transforms  
14MA2004 Laplace Transforms Fourier series and Transforms

**Course objective**
- To make the students capable of analyzing any given electrical network.
- To make the students learn how to synthesize an electrical network from a given impedance/admittance function.
- To make the students to learn the concept of filters.

**Course outcome**
The student will be able to
- Analyze the various electrical and electronic networks using the techniques they learn.
- Analyze three phase circuits.
- Construct a circuit to suit their application

**Description**

**Reference Books**
14EE2004 ELECTROMAGNETIC FIELDS

Credits: 3:1:0

Corequisite: 14MA2001 Vector Calculus and Complex Analysis

Course Objective
- To understand the concept of charge, current and fields
- To calculate electromagnetic field distribution for various configurations
- To impart knowledge on electrostatic, magnetostatic, electromagnetic fields

Course Outcome
The student will be able to
- gain knowledge on vector fields
- solve the advanced EMF problems
- gain knowledge on EM waves and their propagation through various medium

Description

Reference Books

14EE2005 DC MACHINES AND TRANSFORMERS

Credits: 3:1:0

Prerequisite: 14EE2001 Electric Circuits and Networks

Course Objective
- To introduce the concept of rotating machines and the principle of electromechanical energy conversion in single and multiple excited systems.
- To understand the generation of D.C. voltages by using different type of generators and study their performance.
- To study the working principles of D.C. motors and their load characteristics, starting and methods of speed control.

Course Outcome
The student will be able to
- gain knowledge on constructional details of different type of transformers, working principle and its performance
• estimate the various losses taking place in D.C. machines and transformers.
• analyze the different testing methods of electrical machines to arrive at its performance.

Description

Reference Books

14EE2006 DC MACHINES AND TRANSFORMERS LABORATORY
Credits 0:0:2
Corequisite: 14EE2005 DC Machines and Transformers

Course Objective
• Examine the relationship between the electrical and mechanical parameters of a DC electric machine and Transformer.
• Able to determine/predetermine the performance of the selected machine.

Course Outcome
• Based on the load demand, the student will be able to select suitable machine for an application.

Description
The laboratory will demonstrate the student to
• Explore all the possible configurations of a DC machine and Transformers.
• The performance and control characteristics of these configurations and Transformers.
• The method of testing to derive the equivalent circuit of a given design.

Experiments:
The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14EE2007 INDUCTION AND SYNCHRONOUS MACHINES
Credit: 3:1:0

Prerequisite: 14EE2005 DC Machines and Transformers

Course Objective
• To learn the concepts of Synchronous and Asynchronous Machines.
• To understand the effect of performance indicators of the machines.
• To understand the operation of machine on standalone/Infinite bus bar.
Course Outcome
The student will be able to
- Have knowledge of selecting the suitable motor for an application.
- Identify the various operating condition of selected machine.
- Interpret the condition of machine under standalone/Infinite bus bar operations.

Description

Reference Books

14EE2008 AC MACHINES AND CONTROLS LABORATORY

Credits 0:0:2

Corequisite: 14EE2007 Induction and Synchronous Machines

Course Objective
- Able to understand the characteristics of the AC Machine.
- Study the transfer function of a electromechanical system.

Course Outcome
The student will be able to
- Select suitable AC machine for application.
- Determine/predetermine the performance of the selected machine.
- Determine the transfer function of any system.

Description
The laboratory will demonstrate the student about the operation and performance analysis of a AC Machines and derive the transfer function for an electromechanical system.

Experiments:
The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.
14EE2009 ELECTRICAL MACHINE DESIGN

Prerequisites: 14EE2005 DC Machines and Transformers
14EE2007 Induction and Synchronous Machines

Credits 3:1:0

Course Objective
• To impart knowledge on the design aspects of Electrical Machines.
• Good understanding on the design and application of DC and AC machine.
• Knowledge of basic design concepts and cooling arrangement of transformer.

Course Outcome
The student will be able to
• demonstrate the magnetic circuit and electric circuit’s aspects of any machine.
• design the DC and AC machine for any specification given.
• design the transformer and its cooling tubes for the speciation given.

Description

Reference Books

14EE2010 POWER ELECTRONICS

Credits: 3:0:0

Course Objective
• Study the Static and Dynamic characteristics of Power Semiconductor Devices.
• Understand the operation of power electronic converters and its control strategies of various power converters.
• Study the design parameters for control circuitry requirement of various converters.

Course Outcome
The student will be able to
• know the usage of electronics and solid-state power devices for the control, conversion, and protection of electrical energy.
• Design power electronics circuits based on criteria (power, efficiency, ripple voltage and current, harmonic distortions, power factor).
• Select components; interpret terminal characteristics of the components for designing the circuitry for power converters.
Description

Reference Books

14EE2011 POWER ELECTRONICS LABORATORY
Credits 0:0:2
Corequisite: 14EE2010 Power Electronics

Course Objective
- Will enable the students to understand the characteristics of Power Electronic Devices and circuits.

Course Outcome
The student will be able to
- Test and verify the design of Power Converters.
- Use the Data Sheets for the selection of power rating of the device.
- Design suitable power, control and isolation circuits for an application.

Description
This laboratory demonstrates the student to analyze the important operating characteristics of power electronic circuits and power semiconductor devices. Emphasis is on devices, circuits, gating methods and power quality.

Experiments:
The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14EE2012 ELECTRIC DRIVES AND CONTROL

Prerequisite: 14EE2010Power Electronics
14EE2005 DC Machines and Transformers
14EE2007 Induction and Synchronous Machines
Credits: 3:0:0

Course Objective
- Understand the classification and characteristics of Drives.
- Analyze the various types and operations of DC & AC Drives.
- Analyze the operation of Special Machine Drives.

Course Outcome
The students will be able to
- Explain the dynamics of Electrical drive systems.
• Select suitable motor depending upon the loading.
• Select suitable converters and their controls for drive applications.

Description

Reference Books

Credits 3:1:0

Course Objective
• Learn the usage of passive elements in various Power Transmission Systems.
• Understand the factors affecting Insulators.
• Understand the Distribution System.

Course Outcome
The student will be able to
• Analyze the performance of various units involved in the power plants.
• Design a power system solution based on the problem requirements and realistic Constraints.
• Develop a major design experience in distribution system that prepares them for engineering practice.

Description
Basic structure of power system; demand of electrical system – base load, peak load; controlling power balance between generator and load, advantages of interconnected system - Evaluation of Transmission line parameters-types of conductors, representation of transmission line, inductance calculation of single/three phase lines, concept of GMD and GMR, transposition of lines, bundled conductors, skin effect, proximity effect, capacitance calculation of single/three phase lines, Analysis of transmission lines – representation, short/medium/long transmission lines, nominal T/π network, ABCD parameters, surge impedance, Ferranti effect - Insulators for overhead transmission lines - Insulated cables – capacitance of single/three core cable, dielectric loss; Sag - D.C and A.C. distribution, radial and ring main distribution, medium voltage distribution network, low voltage distribution network, single line diagram, substation layout, substation equipments.

References Books
14EE2014 POWER SYSTEM ANALYSIS

Prerequisites: 14EE2007 Induction and Synchronous Machines
14EE2013 Transmission and Distribution

Credits 3:1:0

Course Objective
- To know the concept of power system.
- To understand the concept of per unit system and single line diagram.
- Develop understanding of the basic concepts of load flow, fault analysis, and transient stability.
- Apply this knowledge to model and predict power system behavior.

Course Outcome
The student will be able to
- Demonstrate the ability to model power systems.
- Analyze the impact of short-circuit faults on the power network and make design changes to the network to control the fault currents.
- Understand the dynamic behaviour of power systems and generators.

Description

Reference Books

14EE2015 COMPUTER AIDED POWER SYSTEMS ANALYSIS LABORATORY

Corequisite: 14EE2014 Power System Analysis

Credits 0:0:2

Course Objective
- To enable the students to understand the load flow in a power system.
- To enable the students to do the computation of bus impedance/admittance.
- To enable the students to understand the fault analysis in a power system.
Course Outcome
The student will be able to
- Understand the analysis techniques of a power system.

Description
This laboratory demonstrates the students the usage of simulation software tool for design and control of a Power System.

Experiments:
The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14EE2016 POWER SYSTEM PROTECTION AND SWITCHGEARS

Credits 3:0:0

Prerequisite: 14EE2014 Power System Analysis

Course Objective
- To discuss the causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
- To understand the characteristics and functions of relays and protection schemes.
- To understand the problems associated with circuit interruption by a circuit breaker.

Course Outcome
The student will be able to
- Choose the appropriate relay for the application.
- Design Protective schemes for various Electrical apparatus.
- Analyze the testing of circuit breakers.

Description

Reference Books
14EE2017 LINEAR, DIGITAL IC AND MEASUREMENTS LABORATORY

Credits 0:0:2

Corequisite: 14EC2008 Linear Integrated Circuits

Course Objective
- Analyze and design various applications using Op-amp.
- Design and construct waveform generation circuits.
- Design timer, analog and digital circuits using op-amps.
- Design combinational logic circuits using digital ICs.
- Study of measurement techniques and transducers.

Course Outcome
The student will be able to
- Design any circuit for an application with Linear and Digital ICs.
- Use suitable measurement technique for an application.

Description
This laboratory demonstrates the students the usage of Linear, Digital ICs and measurement of any parameters using suitable instruments.

Experiments:
The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14EE2018 ENERGY SYSTEMS

Credits 3:0:0

Course Objective
To impart knowledge on
- Generation of electrical power by conventional and non–conventional methods.
- Electrical energy conservation, energy auditing and power quality.
- Principle and design of illumination systems and methods of heating and welding.
- Electric traction systems and their performance.

Course Outcome
The student will be able to
- understand energy economics and perform basic energy audit.
- Utilize the electrical energy efficiently.

Description

Reference Books

14EE2019 SPECIAL ELECTRICAL MACHINES

Credits 3:0:0

Prerequisite: 14EE2005 DC Machines and Transformers
14EE2007 Induction and Synchronous Machines

Course Objective
- To impart knowledge on Construction, principle of operation and performance of synchronous reluctance motors.
- To impart knowledge on Construction, principle of operation and performance of Stepping Motors.
- To impart knowledge on Construction, principle of operation, control and performance of permanent magnet brushless D.C. motors.

Course Outcome
The student will be able to
- Select an energy efficient linear or rotary motor based on the characteristics of the load & application.
- Incorporate the correct control technique to the machine for efficient operation.
- Improve the performance of the motor by enhancing the motor suitably.

Description

Reference Books

14EE2020 AUTOMOTIVE ELECTRONICS

Credits 3:0:0

Course Objective
- Study the concepts of sensors, actuators, drives.
- Study Electronics Fuel Injection System and Lighting system and accessories.
- Study the digital control of starting and braking methods in the automobile system.

Course Outcome
The student will be able to
Understand the significance of automation in automobile.
Understand the Digital engine control system.
Understand the significance of automotive electronics in leveraging the passenger safety.

Description

Reference Books

14EE2021 ILLUMINATION ENGINEERING

Credits: 3:0:0

Course Objective
- To design a lighting system including cost estimate and energy efficiency in residential, commercial and industrial establishments.
- To be familiar with the current guidelines in the design, construction, and management of safe and energy-efficient road lighting systems through actual completed projects.
- To understand the concept of lighting system maintenance, basic lighting energy audit and economic analysis of lighting.

Course Outcome
The student will be able to
- Perform indoor & outdoor lighting design calculations.
- Determine appropriate lighting control techniques and equipment to a sample project.
- Perform basic lighting energy audit to a sample project.

Description

Reference Books

14EE2022 POWER SYSTEM STABILITY

Credits 3:0:0

Prerequisite: 14EE2014 Power System Analysis

Course Objective
- Impart knowledge about the concept of stability in a Power System.
- Make the students understand the importance of stability under different conditions like transient and steady state in the power system.
- Learn the methods of improving the stability & use of computations for the analysis of this stability.

Course Outcome
The student will be able to
- Realize the disturbances in the power system under various operating conditions.
- Have knowledge about maintaining and improving the stability of a system.
- Get knowledge on methods to analyze transient and steady state stability of a power system.

Description

Reference Books

14EE2023 POWER SYSTEM OPERATION AND CONTROL

Credits 3:0:0

Prerequisite: 14EE2014 Power System Analysis

Course Objective
- Understand & model power-frequency dynamics and to design power-frequency Controller.
- Understand & model reactive power-voltage interaction.
• Understand different methods of control for maintaining voltage profile against varying System load.

Course Outcome
The student will be able to
• Realize the importance of maintaining the frequency and voltage within the safe range.
• Have knowledge about modeling of systems under varying conditions
• Get knowledge on SCADA system, its function and state estimation concepts

Description

Reference Books

14EE2024 BASICS OF ELECTRIC AND HYBRID VEHICLE

Credits: 3:0:0

Course Objective
• To understand the concepts of electric and hybrid vehicle
• To know the necessity of alternative and novel energy sources.
• To study the various machines and controller used in electric and hybrid vehicle.

Course Outcome
The student will be able to
• Develop a hybrid vehicle with existing renewable system.
• Design a new controller for hybrid electric vehicle.
• Apply control techniques to store the energy.

Description

Reference Books

14EE2025 FUNDAMENTALS OF ELECTRICAL SAFETY

Credits: 3:0:0

Course Objective
- Understand the various reasons for electrical accidents
- Exhibit knowledge of safety rules and regulations, and demonstrate awareness of hazards in the workplace.
- Explain the use of personal protective equipment.

Course Outcome
The student will be able to
- Demonstrate proper safety procedures.
- Demonstrate proper use of hand and power tools.
- Create awareness on electrical safety to others.

Description

Reference Books
3. Indian Electricity Act and Rules, Government of India.

14EE2026 HIGH VOLTAGE ENGINEERING

Credits: 3:0:0

Course Objectives
- To understand the various types of over voltages in power system and protection methods.
- To impart knowledge of Breakdown mechanism in solid, liquid and gaseous dielectrics.
To study the Generation and Measurement techniques of High voltages and Current.

Course Outcomes
The student will be able to
- Understand the causes of over voltages and Insulation Coordination.
- Understand generation and measurement of High Voltages and Currents.
- Testing of Electrical Power Apparatus

Description

Reference Book

14EE2027 HVDC AND FACTS

Credits: 3:0:0

Course Objective
- To study the various types of Modern transmission systems
- To impart knowledge on HVDC and FACTS
- To study the effect of FACTS controllers on AC transmission system

Course Outcome
The student will be able to
- Understand the various components of HVDC and FACTS.
- Analyze the different control schemes of HVDC and FACTS systems.
- Derive the optimal operating condition for HVDC and FACTS systems.

Description

Reference Books

**14EE2028 BUILDING AUTOMATION**

**Credits:** 3:0:0

**Course Objective**
- Understand about the building automation and its management system.
- Study about the security and safety systems in smart building.
- Suggest suitable possibilities to integrate system and its managements for intelligent building.

**Course Outcome**
The student will be able to
- Construct and design structured building system by enabling integrated system connections.
- Apply the building automation system and telecommunication facilities in modern intelligent buildings; and apply networking technologies in building automation.
- Evaluate the comprehensive specifications of the importance of energy conservation components for a modern commercial building.

**Description**

**Reference Books**

**14EE2029 DESIGN LABORATORY**

**Credits:** 0:0:1

**Corequisite:** All the departmental core subjects

**Course Objective**
- To motivate the students to do develop a project with their own ideas.

**Course Outcome**
- Will enable the students to design, fabricate the circuits for a project.
- Usage of Data Sheets for the selection of Electrical, Electronics and Power Electronics components.
Description
This laboratory demonstrates the students about the stages of developing a project.

Experiments:
The faculty conducting the laboratory will prepare a list of 6 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14EE2030 POWER SYSTEM SIMULATION LABORATORY

Corequisite: All the professional core subjects

Credits: 0:0:2

Course Objective
- To expose the students to the usage of Modern Simulation Software for Electrical Engineering.

Course Outcome
- Will enable the students to simulate circuits using MATLAB / SIMULINK and PSIM.
- Able to do harmonic analysis, spectral studies; power quality analysis etc during the simulation.

Description
This laboratory demonstrates the students about the implementation and control of any electrical engineering problems using modern simulation softwares.

Experiments:
The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14EE2031 Renewable Energy – I

Credits 3:0:0

Course Objective
- To know the basics of solar energy and photovoltaic technology.
- To know the basics of wind energy.
- To know about hybrid energy systems.

Course Outcome
The student will be able to
- Simulate power generation systems using solar and wind energies.
- Understand the Grid connection of Renewable Energy sources.
- Model wind energy conversion systems.

Description
Reference Books

14EE2032 RENEWABLE ENERGY – II

Credits 3:0:0

Course Objective
- To know the basics of Biomass Energy.
- To know the basics of Hydro, Geothermal, Wave and Oceanic energies.
- To know the power generation techniques using the Bio-waste and water.

Course Outcome
The student will be able to
- Simulate power generation systems using Bio-waste and water based energies.
- Model energy efficient biomass plant and energy conversion systems for water based energy systems.

Description
Biomass resources and their classification - chemical constituents and physicochemical characteristics of biomass - Biomass conversion processes (Thermo chemical conversion, biochemical conversion & chemical conversion) – Bio-gasifier – Biogas plants - Hydrogen: Thermodynamics and electrochemical principles - production methods – Biophotolysis - Storage gaseous, cryogenic and metal hydride and transportation – Fuel Cells – Hydro systems - Hydro System resources – types of hydro turbine – small hydro systems; Geothermal, wave energy, ocean energy – Case studies.

Reference Books

14EE2033 HARMONICS AND POWER QUALITY

Credits 3:0:0

Course Objective
- To Study the different causes of power quality issues.
- To study the effect of harmonics and voltage fluctuations on power system performance.
- To study the design aspects of filters to mitigate harmonics and voltage fluctuations.

Course Outcome
The student will be able
- To devise suitable harmonic elimination technique to improve power quality.
- To assess the power quality.
- Follow the International standards of power quality.
**Description**


**Reference Books**


---

14EE2034 POWER SYSTEM RELIABILITY

**Credits** 3:0:0

**Prerequisite:** 14EE2013 Transmission and Distribution

**Course Objective**

- To understand the importance of reliability.
- To study the reliability evaluation.
- To understand the basic reliability indices.

**Course Outcome**

The student will be able to

- Evaluate the reliability of a power system.
- Evaluate the reliability of other physical system.
- Develop new reliability evaluation methods.

**Description**

Basic Probability Theory: Review of probability concepts, probability distributions, application of binomial distribution to engineering problems, network modeling and system reliability evaluation using probability distributions, frequency and duration techniques. Generation, Transmission and Distribution System Reliability Evaluation: Concept of LOLP and E(DNS), evaluation of these indices for isolated systems.

**Reference Books**

14EE2035 SWITCHED MODE POWER SUPPLIES

Credits 3:0:0

Prerequisite: 14EE2010 Power Electronics

Course Objective
- To understand the basics of Switched Mode Power Supplies.
- To study the control behind the switching mode power supplies.
- To know the various hardware modules available.

Course Outcome
The student will be able to
- Design and fabricate a power source using static switches.
- Devise new techniques to make the power source more energy efficient.
- Design proper protective scheme against EMI.

Description

Reference Books

14EE2036 SMART GRID

Credits 3:0:0

Prerequisite: 14EE2013 Transmission and Distribution

Course Objective
- To understand the structure of a smart grid
- To understand various functional units of smart grid
- To understand the impacts of renewable resources to the grid and the various issues associated with integrating such resources to the grid

Course Outcome
The student will be able to
• Construct the smart grid network
• Apply various communication technologies for smart grid network
• Implement the various power electronic modules in the network

Description
Introduction to Smart Grid-Need of smart grid- Smart grid communications: Two way digital communications paradigm, power Line communication-Information security for smart grid-Smart metering – Distribution management systems- Pricing and Energy Consumption Scheduling-Renewable Energy resource interconnection issues-Wide Area Measurements-Power electronics in the smart grid- Energy Storage-Future of smart grid

References Books

14EE2037 COMPUTER AIDED GRAPHICS FOR ELECTRICAL ENGINEERS

Credits 0:0:2

Course Objective
• To understand the usage of computer graphics for electrical engineering.
• To understand the 3D view of a Machine.
• To understand the layout of a power system.

Course Outcome
The student will be able to
• Use graphical software for the design of electrical systems
• Draw layout diagram for electrical installations

Description
This laboratory demonstrates the students about the usage of Computer Graphics for Electrical Engineering.

Experiments:
The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14EE2038 ADVANCED TOPICS IN POWER ELECTRONICS

Credits 3:0:0

Prerequisite: 14EE2010 Power Electronics

Course Objective
• To give exposure to new emerging devices in the field of Power Electronics.
• To study the advanced inverters for the control of Electric Drives.
• To impart knowledge on protection of power electronic devices.

Course Outcome
The student will be able to
• Select the power devices based on the requirement of control.
• Select suitable power electronic controller for control applications.
• Construct new power electronic circuits.


**Description**


**Reference Books**


**14EE3001 POWER SEMICONDUCTOR DEVICES**

**Credits: 3:0:0**

**Course Objective**

- To understand various static and dynamic performances of static switches.
- To familiarize the student on switching and steady state characteristics power electronic devices.
- To analyze the control circuits and switching losses in power devices.

**Course Outcome**

- Design switching circuits using power semiconductor devices.
- Specify design criteria (power, efficiency, ripple voltage and current, harmonic distortions, power factor).
- Selecting the components, interpreting the terminal characteristics of the components, modeling components, designing the circuit, and understanding operation of power electronics circuits.

**Description**


**Reference Books**

14EE3002 POWER CONVERTERS AND ANALYSIS - I

Credits: 3:0:0

Course Objective
- To give in depth knowledge of the various power electronics circuits
- To analyze the behavior of the Power Electronic circuits along with the design.
- To understand the control methods of various power converters.

Course Outcome
- Analyze the converter circuits and select them for the suitable applications.
- Trouble shooting the power electronic circuits
- Design various driver circuits for the converters

Description

Reference Books

14EE3003 POWER CONVERTERS AND ANALYSIS - II

Credits: 3:0:0

Course Objective
- To give in depth knowledge of the inverters and its configurations
- To analyze the behavior of the Power Electronic circuits along with their design
- To understand the control methods of various power converters

Course Outcome
- Analyze the converter circuits and select them for the suitable applications
- Construct PE system for specific applications
- Design various driver circuits for the converters

Description
Reference Books

14EE3004 SOLID STATE DC DRIVES

Credits: 3:0:0
Prerequisite: 14EE3002 Power Converter Analysis -I

Course Objective
- To understand the fundamentals of various electromechanical systems.
- To understand the basic concept of DC Drives.
- To understand the various control techniques involved with DC Drives.

Course Outcome
- Design and Analyze different control techniques of DC Drives.
- Select suitable DC Drive for different requirements
- Apply appropriate control method for the application.

Description
Dynamics of Electrical Drives-Torque Equation-Multi quadrant Operation-Speed control and Drive Classifications-DC motor Drives-Speed control – Analysis of series and separately excited DC motors with single-phase and three-phase converters - Class A, B, C, D and E chopper controlled DC motor – Chopper based implementation of braking schemes - Multi-phase chopper – Modeling of drive elements – Equivalent circuit - Closed loop control of Drives, Simulation of converter and chopper fed DC drive - Phase Locked Loop and micro-computer control of DC drives.

Reference Books

14EE3005 SOLID STATE AC DRIVES

Credits: 3:0:0
Prerequisite: 14EE3003 Power Converter Analysis -II

Course Objectives
- To understand various operating regions of the induction motor drives.
To study and analyze the operation of VSI & CSI fed induction motor control.
To understand the speed and torque control techniques of induction motor drive from the rotor.
To understand the field oriented control of induction machine.
To understand the control of synchronous motor drives.

Course Outcome
- Design and Analyze different control techniques of AC Drives
- Select suitable AC Drive for different requirements
- Apply appropriate control method for the application

Description
Induction Motor Drives: Variable voltage, constant frequency operation – Variable frequency operation, constant Volt/Hz operation. Drive operating regions, variable stator current operation, different braking Methods-AC voltage controller circuit – six step inverter voltage control-closed loop variable frequency PWM inverter with dynamic braking-CSI fed IM variable frequency drives-Static rotor resistance control - injection of voltage in the rotor circuit – Static Scherbius drives -power factor considerations – modified Kramer drives-Field oriented control of induction machines– DC drive analogy – Direct and Indirect methods – Flux vector estimation - Direct torque control of Induction Machines – Torque expression with stator and rotor fluxes, DTC control strategy- Power factor control– starting and braking, self control –Load commutated Synchronous motor drives - Brush and Brushless excitation - Sensor-less Vector Control of AC Drives.

Reference Books

14EE3006 WASTE TO ENERGY CONVERSION

Credits 3:0:0

Course Objective
- To understand the waste processing techniques, its treatment and disposal
- To study the different conversion process involved.
- To understand the environmental and health impacts of waste to energy conversion.

Course Outcome
- The student will be able to identify different types of waste and its processing techniques.
- The student will be mastering in Recovering Energy from Waste and thereby help in developing a green society.
- Gain knowledge about the eco-technological alternatives for waste to energy conversions.

Description
studies of commercial waste to energy plants, - eco-technological alternatives for waste to energy conversions – Rules related to the handling, treatment and disposal of MSW and BMW in India.

Reference Books:

14EE3007 GENERALIZED THEORY OF ELECTRICAL MACHINES

Credits: 3:0:0

Course Objective
- To impart knowledge on the generalized representation and model of electrical machines.
- To impart knowledge on the steady state and analysis of electrical machines using the model
- To impart knowledge on various reference frames

Course Outcome
The students will be able to
- Describe the Generalized Representation of machines and their analysis.
- Describe the steady state analysis and transient analysis of various machines.
- Describe the performance of Induction and Synchronous machines and their representation.

Description

Reference Books
14EE3008 SPECIAL MACHINES AND CONTROLLERS

Credits: 3:0:0

Course Objective
- To impart knowledge on the construction, principle of operation and the control techniques of stepper motor and Switched Reluctance Motors.
- To study the characteristics of permanent magnet brushless DC motor
- To understand the control methods, applications of PMSM and linear motors

Course Outcome
- Differentiate the working of different drives and performance
- Select a suitable special machine drive based on the application
- Incorporate an appropriate control scheme for the application specified

Description

Reference Books

14EE3009 POWER ELECTRONICS LABORATORY

Credits: 0:0:1

Corequisite:
- 14EE3002 Power Converter Analysis – I
- 14EE3003 Power Converter Analysis – II

Course Objective
- Learn the principles of operation, simulation and design procedures of ac-dc rectifiers.
- Learn the principles of operation, simulation and design procedures of dc-dc converter.
- Learn the principles of operation, simulation and design procedures of Cycloconverter and resonant Converter.

Course Outcome
- Students are introduced to hardware, software, and measurement techniques used in power electronic systems
- Students are exposed to analysis, design, and applications of power electronic converters.
**Description**
This laboratory demonstrates the students the simulation and design of various converters.

**Experiments:**
The faculty conducting the laboratory will prepare a list of 6 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14EE3010 ELECTRIC DRIVES AND CONTROL LABORATORY

**Credits:** 0:0:1

**Corequisite:** 14EE3004 Solid State DC Drives
14EE3005 Solid State AC Drives

**Course Objective**
- To prepare students for the processes of design and operation for electric drive systems requiring knowledge of the specifics and characteristics of electric motors as objects of control.

**Course Outcome**
The student will be able to
- Derive expressions for forces and torques in electromechanical devices.
- Understand how power electronic converters and inverters operate.
- Possess an understanding of feedback control theory.
- Develop control algorithms for electric drives which achieve the regulation of torque, speed, or position in the above machines.
- Develop Simulink® models which dynamically simulate electric machine and drive systems and their controllers.

**Description**
The lab will consist of giving the students hands-on experience with electric machines (AC and DC), power electronic circuitry, and control algorithms for electric drives.

**Experiments:**
The faculty conducting the laboratory will prepare a list of 6 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14EE3011 PHOTOVOLTAIC SYSTEMS

**Credits:** 3:0:0

**Course Objective**
- To provide necessary knowledge about the modeling, design and analysis of various PV systems
- To show that PV is an economically viable, environmentally sustainable alternative to the world's energy supplies
- To understand the power conditioning of PV system’s power output.

**Course Outcome**
- Model, analyze and design various photovoltaic systems
- Know the feasibility of PV systems as an alternative to the fossil fuels
- Design efficient stand alone and grid connected PV power systems

**Description**
Historical development of PV-Overview of PV usage-Solar Radiation and spectrum of sun- geometric and atmospheric effects of sunlight-Photovoltaic effect. Solar cells and arrays- Structure and characteristics- modeling of solar-PV Generators- Energy storage alternatives for PV Systems-Types – Modeling - Inverter control topologies for standalone and grid connected system-Power conditioning and maximum power point tracking (MPPT)- Active
power filtering with real power injection—Modeling and simulation of complete stand-alone and grid-connected PV systems.

**Reference Books**

---

### 14EE3012 POWER ELECTRONIC CIRCUITS

**Credits** 3:0:0

**Course Objective**
- To impart the knowledge of various conversion techniques of electrical energy using power electronic components.
- To establish the link between efficient usage of power and conservation of energy resources of the world.
- To provide the design details of various power electronic converters.

**Course Outcome**
- Understand the significance of the characteristics of various power semiconductor switches
- Design of power electronic conversion systems
- Understand various modulation (control) techniques such as pulse width modulation and selective harmonic elimination.

**Description**

**Reference Books**

---

### 14EE3013 ENERGY ENGINEERING

**Credits** 3:0:0

**Course Objective**
- To create environment-friendly and energy-efficient systems.
- To deal with actively harnessing renewable natural resources like solar energy and utilizing materials that cause the least possible damage to the global commons – water, soil, forests and air.
- To deal with global and Indian energy scenario.
Course Outcome

- Effectively manage the energy requirements
- Work out for the new available sources and its utilization
- Manage the environmental issues regarding the energy sources

Description

Reference Books


14EE3014 WIND ENERGY

Credits: 3:0:0

Course Objective

- To develop a detailed understanding of the issues associated with the development of wind energy for electrical energy supply.
- To know the current state of wind energy development domestically and internationally
- To understand the issues of location and grid connection of wind energy power plants.

Course Outcome

- Understand the role which wind energy plays and can play in the electricity supply system and its role in meeting the country’s obligations in terms of greenhouse gas abatement.
- Gain knowledge regarding wind energy resources and the ability to assess those resources.
- Gain knowledge of construction, characteristics, control and performance of wind turbines.

Description

Reference Books


14EE3015 HYDROGEN AND FUEL CELLS

Credits: 3:0:0

Course Objective
- To understand hydrogen energy technology
- To understand fuel cell technology
- To enlighten the student community on various technological advancements, benefits and prospects of utilizing hydrogen/fuel cell for meeting the future energy requirements.

Course Outcome
- Know detail on the hydrogen production methodologies, possible applications and various storage options.
- Know the working of a typical fuel cell, its types and to elaborate on its thermodynamics and kinetics
- Analyze the cost effectiveness and eco-friendliness of Hydrogen and Fuel Cells.

Description

Reference Books

14EE3016 ENERGY MANAGEMENT AND AUDIT

Credits: 3:0:0

Prerequisite: 14EE3013 Energy Engineering

Course Objective
- To understand various energy management techniques.
- To understand energy auditing techniques.
- To familiarize with energy related policies.

Course Outcome
- Become efficient energy managers
- Know different energy auditing methods.
- Suggesting energy saving methods.
**Description**


**Reference Books**

6. World on transition-Towards sustainable Energy systems, German Advisory council on global change Handbook, Earthscan publication, 2004

---

**14EE3017 ENERGY MODELING, ECONOMICS AND PROJECT MANAGEMENT**

**Credits:** 3:0:0

**Prerequisite:** 14EE3013 Energy Engineering

**Course Objective**

- To impart greater understanding of energy modeling in renewable energy technology.
- To throw light on the economic aspects involved in renewable energy technology.
- To enlighten the students on the various techniques involved in project management.

**Course Outcome**

- Gain clear perspective on energy economy.
- Forecast the energy demand and plan wisely.
- Become excellent managers of the energy resources.

**Description**


**Reference Books**

14EE3018 SOLAR ENERGY LABORATORY

Credits: 0:0:1

Corequisite: 14EE3011 Photovoltaic Systems

Course Objective
- To learn the characteristics of a solar cell and PV array.
- To learn the algorithms for efficient and optimal power tracking of PV modules.

Course Outcome
The student will be able to
- Select suitable solar cell.
- Use suitable measurement technique for solar insolation level.
- Use suitable control algorithm for achieving maximum power point.

Description
This laboratory demonstrates the students to study the characteristics of a PV cell, PV array and control the PV array for maximum power point tracking.

Experiments:
The faculty conducting the laboratory will prepare a list of 6 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14EE3019 WIND ENERGY LABORATORY

Credits: 0:0:1

Corequisite: 14EE3014 Wind Energy

Course Objective
- To study the various wind power forecasting techniques.
- To learn the control algorithm for maximum power operation.
- To learn the modeling techniques for wind power system.

Course Outcome
The student will be able to
- Assess the wind resources at a site.
- Model a suitable wind power system and implement a suitable controller for maximum wind power.

Description
This laboratory demonstrates the students the modeling and control of a wind power system.

Experiments:
The faculty conducting the laboratory will prepare a list of 6 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14EE3020 POWER ENGINEERING SIMULATION LABORATORY

Credits: 0:0:1

Course Objective
- To simulate any power electronic circuit or solve any power engineering problem.

Course Outcome
The student will be able to
- Simulate any circuit for an application using technical softwares.
Solve the power engineering problems by programming.

**Description**
This laboratory demonstrates the students the usage of technical softwares like MATLAB/SIMULINK, PSIM, PSCAD etc.

**Experiments:**
The faculty conducting the laboratory will prepare a list of 6 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

---

**14EE3021 FLEXIBLE AC TRANSMISSION SYSTEMS**

**Credits:** 3:0:0

**Course Objective:**
- To introduce the students to the concept of FACTS, and familiarize them with the basic design and principle of operation of HVDC systems.
- To understand the implementation of UPFC in real time applications.
- To design the FACTS controllers for various non-linear structure controls.

**Course Outcome**
- Identify, formalize, model and analyze problems in a power network
- Select the suitable FACTS devices to enhance the security, capacity and flexibility of Power transmission systems.
- Increase existing transmission network capacity while maintaining or improving the operating margins necessary for grid stability.

**Description**

**Reference Books**

---

**14EE3022 HVDC TRANSMISSION**

**Credits:** 3:0:0

**Course Objective**
- To have an overview about HVDC system, Converters and various means of control
- To analyze the various malfunctioning of the HVDC system
- To study the basics of harmonics and their reduction mechanism

**Course Outcome**
- Outline the benefits of using dc transmission and its operation & control
- Use the various power electronics resources for the betterment of HVDC system
• Analyze the challenges and its solutions available in high voltage engineering

**Description**

**Reference Books**

**14EE3023 INDUSTRIAL POWER SYSTEM ANALYSIS AND DESIGN**

**Credits: 3:0:0**

**Course Objective**
The students will be able to
- Understand operational and maintenance requirements of power system
- Apply the appropriate industry recognized design standards to a design
- Study various disturbing power system parameters

**Course Outcome**
Students will be able to
- Understand the terminology used in the context of an electrical distribution system
- Use simple “rules of thumb” to estimate the performance and economics of an electrical distribution systems design
- Design an industrial power system with appropriate safety, economic reliability

**Description**

**Reference Books**

14EE3024 DISTRIBUTED GENERATION

Credits: 3:0:0

Course Objective
- To understand the structure of an regulated or deregulated market conditions
- To understand power architecture and control strategies
- To understand the impacts of renewable resources to the grid and the various issues associated with integrating such resources to the grid

Course Outcome
Students will be able
- To implement Distributed Generation network
- To install various Distributed Generation Units
- To realize various power electronic modules in the network

Description
Distributed Generation (DG) - Overview and technology trends - The electric grid vs. Microgrids-Distributed Generation units. Microturbines, reciprocating engines, wind generators, photovoltaic generators, fuel cells, and other technologies- Power electronics interfaces: AC-DC and DC-AC-Power architectures: distributed and centralized. Dc and ac distribution-Controls: distributed, autonomous, and centralized systems-Grid interconnection. Issues, planning, advantages and disadvantages both for the grid and the microgrid.

Reference Book

14EE3025 COMMUNICATIONS AND CONTROL IN SMART GRID

Credit: 3:0:0

Course Objective
The students will be able to
- Comprehend the new multi-disciplinary field of Smart Grid
- Study communication protocols
- Understand various control Technology

Course Outcome
At the end of the course the students will be able to
- Design and Implement the concept of a smart grid.
- Integrate the latest communication system with smart grid.
- Develop customized cyber security system

**Description**

Smart Grid Definition-Smart Grid Communications: Two-way Digital Communications Paradigm- Power Line Communications-Advanced Metering Infrastructure- Pricing and Energy Consumption Scheduling- Phasor Measurement Units-Communications Infrastructure- Cyber Security Challenges in Smart Grid – SCADA – DCS.

**Reference Book**


**14EE3026 ELECTRICAL TRANSIENTS IN POWER SYSTEMS**

**Credit: 3:0:0**

**Course Objectives**

- To study the fundamentals of travelling waves on transmission line
- To analyze the various computation methods for power system transients
- To study the behavior of lightning, winding oscillation and insulation coordination

**Course Outcome**

- Able to analyze the transients with suitable computation method
- Able to learn the behavior of winding, insulation and lightning under transients conditions
- Able to use the optimization method to solve the problems of transients

**Description**

Impact of power electronics switches in power systems, Lumped and Distributed Parameters, Wave Equation, Reflection, Refraction, Behavior of Travelling waves at the line terminations, Lattice Diagrams, Attenuation & Distortion, Multi-conductor system and Velocity wave. Principle of digital computation, Switching: Short line or kilometric fault, Energizing transients: closing and re-closing of lines, line dropping. Voltage induced by fault, Very Fast Transient Overvoltage (VFTO) Initial and Final voltage distribution, Winding oscillation, Behavior of the transformer core under surge condition. Rotating machine, Surge in generator and motor. IEC and IEEE standards.

**Reference Books**


**14EE3027 POWER ELECTRONICS FOR HIGH POWER APPLICATIONS**

**Credit: 3:0:0**

**Course Objectives**

- To study the fundamentals of parameters of HV lines
To analyze the application of Power electronics in High voltage lines
To study the effects of corona and electrostatic field effect in EHV lines

Course Outcome
- Able to choose the optimal values of resistant, inductance and capacitance for multiconductor lines
- Able to analyze the voltage gradients, corona effects and effect of electrostatic field of HV line.
- Able to design appropriate converter and controllers

Description

Reference Books

14EE3028 POWER SYSTEM PLANNING AND RELIABILITY

Credit: 3:0:0

Course Objectives
- To study the fundamentals of load forecasting and its types
- To analyze the generation and transmission system reliability
- To study the expansion planning in transmission and distribution system.

Course Outcome
- Able to understand effect of load forecasting
- Able to analyze the generation and transmission system reliability
- Able to learn expansion planning in transmission and distribution system.

Description
Objectives of forecasting, Load growth patterns and their importance in planning, Multiple regression technique, Weather sensitive load forecasting, Annual forecasting, Use of AI in load forecasting, Probabilistic generation and load models, Determination of LOLP and reliability of ISO and interconnected generation systems, Deterministic contingency analysis-probabilistic load flow-Fuzzy load flow probabilistic transmission system reliability analysis, Determination of reliability indices like LOLP and expected value of demand not served. Expansion planning procedures followed for integrated transmission system planning, Capacitor placing problem in transmission system and radial distributions system. Sub transmission lines and distribution substations-Design primary and secondary systems-distribution system protection and coordination of protective devices.

Reference Books

14EE3029 ELECTRIC AND HYBRID VEHICLES

Credit 3:0:0

Course Objective
- To understand the concept of Electric Vehicle Technology.
- To understand various types Electric Vehicle (EV) technology.
- To know about various Electrical propulsion system.

Course Outcome
- The students will be able to understand the need of Hybrid Vehicles and Electric vehicles.
- The students will be able to design different types of Electric & Hybrid Vehicles.
- The student will be able to use the energy on-board optimally.

Description

Reference Books

14EE3030 MODELLING AND DESIGN OF ELECTRIC AND HYBRID VEHICLE

Credit 3:0:0

Prerequisite: 14EE3029 Electric and Hybrid Vehicles

Course Objective
- To understand the factors those influence the performance of EHV.
- To understand need for mathematical modelling of EHV.
- To understand the modelling for EHV drives.

Course Outcome
- The students will be able to understand the merits and demerits of various mathematical models of Electric and Hybrid Vehicle.
- The students will be able to design the EHV using the mathematical Model.
- The students will be able to simulate and observe the behaviour of the EHV.
Description

Reference Books

14EE3031 POWER MANAGEMENT FOR HEV

Credit: 3:0:0

Course Objective
- To understand the need for power management of HEV.
- To understand analytical controller.
- To understand the Controller modelling for EHV drives.

Course Outcome
- The students will be able to understand the need of mathematical Modelling the Electric and Hybrid Vehicle.
- The students will be able to design the EHV using the mathematical Model.
- The students will be able to simulate and observe the behaviour of the EHV.

Description

Reference Books

14EE3032 HYBRID-ELECTRIC VEHICLE POWERTRAINS

Credits: 3:0:0

Prerequisite: 14EE3029 Electric and Hybrid Vehicles

Course Objective
- Study the energy requirements for hybrid electric vehicles.
- Understand the operation and characteristics of various motors used in electric vehicles.
• Study the operation of various converters for driving motors in electric vehicles and hybrid electric vehicles.

Course Outcome
The student will be able to
• know the energy requirements for hybrid electric vehicles and importance of using high efficiency motors and converters.
• know the selection and usage of various electric motors in electric and hybrid electric vehicles.
• select suitable power electronic converter for driving motors in EV and EHV so as to deliver maximum efficiency and energy regeneration.

Description:

Reference books

14EE3033 VEHICLE ENERGY STORAGE SYSTEMS

Credits: 3:0:0

Course Objective
• Study the methods of energy storage in electric vehicles.
• Understand the operation of various storage devices, their characteristics and maintenance.
• Study the various parameters affecting the service life of battery and other storage devices.

Course Outcome
The student will be able to
• know the usage of various storage devices that can be particularly used in electric vehicles.
• manage the energy requirement when multiple sources are used for storing and/or generation.
• Select a suitable storage device; interpret their characteristics and parameters.

Description:

Reference books:

14EE3034 ELECTRIC VEHICLE BATTERY TECHNOLOGY

Credits: 3:0:0

Course Objective
- Study in detail about the various types of batteries for EV, their operation and characteristics.
- Understand the equivalent circuit and modeling of battery.
- Study the battery management system and its function in EV.

Course Outcome
The student will be able to
- know the performance of various types of batteries for EV.
- model a battery based on the parameters of the battery.
- know the functions of energy management system and deploying it in an EV.

Description:

Reference Books:
14EE3035 MODELING OF POWER CONVERTERS

Credits: 3:0:0

Prerequisite: 14EE3002 Power Converter Analysis – I
  14EE3003 Power Converter Analysis – II

Course Objective
• To impart the knowledge of latest advances in the field of power electronics.
• To understand the basics of modeling of power converters.
• To introduce the phenomena of non-linearity in power converters.

Course Outcome
• To understand the effect of power electronic converter in a system using their models and transfer functions
• Ability to design filters for converters
• To understand the impact of non-linear phenomena in power electronic circuits

Description

Reference Books

14EE3036 POWER ELECTRONICS IN WIND AND SOLAR POWER CONVERSION

Credits: 3:0:0

Course Objective
• To study the role of power electronics in various photovoltaic energy conversion and wind energy conversion.
• To analyze the performance of various converters and inverters.
• To learn the integration of renewable energy conversion system with the grid.

Course Outcome
• Design PV systems to meet the requirement of battery operated vehicle and other related applications
• Understand various factors which affect the wind energy conversion system.
• Design isolated power generators used in wind energy conversion system.

Description

**Reference Books**

**14EE3037 DSP CONTROLLERS FOR POWER CONVERTERS AND DRIVES**

**Credits: 3:0:0**

**Course Objective**
- Basics of motion control Digital Signal Processor and generation of PWM Signals
- Concept of Event Handling, Interrupts and Interface Conversion
- Control of Motor using a DSP

**Course Outcome**
- Select a suitable Digital Signal Processor for the control of the machine.
- Implement the DSP based Control for the machine.
- Use real time DSP system for online control

**Description**

**Reference Books**

**14EE3038 POWER QUALITY**

**Credits 3:0:0**

**Course Objectives**
- To study the power quality problems in grid connected system and isolated systems.
- To study the various power quality issues and mitigations techniques.
- To study about the various harmonics elimination methods.
Course Outcomes

- Ability to apply knowledge of power quality and harmonics in power systems, and engineering to the analysis and design of electrical circuits.
- Ability to design a system, components or process to meet desired needs within realistic constraints and to mitigate PQ problems such as economic, environmental, social, ethical, health and safety.
- Ability to function on multi-disciplinary teams for power quality improvement.

Description


Reference Books


14EE3039 TIDAL ENERGY

Credits 3:0:0

Course Objective

- To provide necessary knowledge about the basics, design and analysis of tidal energy.
- To make the learner to understand the operation of tidal power plants.
- To impart the basic knowledge about integration of tidal power plants with grid

Course Outcome

- Have awareness about the possibilities of power generation from tides
- Suggest new mechanisms to harvest energy from tides
- Design efficient tidal power plants

Description

Tides – Generating Forces – Enumerate and discuss all forces and periodicities related to tides – Analysis and prediction of tides and tidal current – methods to analyze sea level and current by classic harmonic analysis and by selected modern tools related to energy spectra. Structure of tidal currents – effects of intense turbulence generated by tides which erases vertical stratification and forms the tidal fronts in shallow water domains – Tidal dynamics – Using Kelvin and Sverdrup Waves to explain primary features of the observed tides – Introduction to numerical solution of the tidal equation – Tidal Power – Basic laws of tidal energy generation, transport and dissipation – Harnessing the power of tides for the generation of electricity – Impacts of tides on Climate.

Reference Books:


**14EE3040 SIMULATION OF POWER ELECTRONIC SYSTEMS**

**Credits:** 3:0:0

**Prerequisite:** 14EE3014 Power Electronic Circuits/  
14EE3002 Power Converter Analysis – I &  
14EE3003 Power Converter Analysis - II

**Course Objective**
- To study the basics of static and dynamic models of power electronic switches
- To learn the usage of the software tools like MATLAB, PSIM and PSPICE
- To understand the operation of different types of power electronic converters using the above mentioned tools

**Course Outcome**
- do the mathematical modeling of power devices under steady state and dynamic conditions
- use the various functional blocks available in the simulation packages for the problems specified
- design and simulate any power electronic circuits and compare the performance with other simulation tools

**Description**

**Reference Books**

**14EE3041 POWER ELECTRONICS APPLICATIONS TO POWER SYSTEMS**

**Credits:** 3:0:0

**Course Objective**
- To understand the safe and secure operation of simple power system.
- To suggest suitable possibilities to extend power system operation.
- To understand the recent advancements in power systems using the power electronic systems.

**Course Outcome**
- Find the solutions for eliminating harmonics and EMI present in the output due to fast switching devices.
- Apply power system fundamentals to the design of a system that meet specific needs.
- Design necessary filter circuit require to the distributed network.
Description

Reference Books

14EE3042 NEURO-FUZZY CONTROLLERS FOR ELECTRIC DRIVES

Credits3:0:0

Course Objective
- To impart the knowledge on the fundamental concept of neurons and their artificial models
- To understand the Structure of fuzzy logic controller and its application to electric drives
- To provide comprehensive knowledge of fuzzy logic and neuro controllers

Course Outcome
- Explain the various learning algorithms derived from the biological neurons
- Apply the concept of neural network for optimization of any system problem
- Use appropriate network for fault diagnosis and pattern recognition.

Description

Reference Books
14EE3043 ADVANCED CONTROL TECHNIQUES FOR INDUCTION GENERATORS

Credits: 3:0:0

Prerequisite: 14EE3014 Wind Energy

Course Objective
- To understand the transient and steady state modeling of induction generators.
- To give an in-depth knowledge about the different control techniques of induction generators.
- To enhance the students’ perspective on optimized control of induction generators which are widely used in renewable energy systems.

Course Outcome
- Understand the complex control concepts
- Ensuring energy economy and efficiency.
- Apply the optimization techniques for maximum performance

Description

Reference books

14EE3044 OPTIMAL CONTROL OF WIND ENERGY SYSTEMS

Credits: 3:0:0

Prerequisite: 14EE3014 Wind Energy

Course Objective
- To understand the importance of optimal control in wind energy systems
- To impart the basics of modeling of wind energy conversion system
- To introduce the various parameters that need to controlled in wind energy systems

Course Outcome
- Learn the various techniques that can be used to obtain optimal control
- Lay the basics of efficient control of wind energy systems and thus to make wind power a main source of renewable energy
- Ability to innovate on new control techniques for a efficient wind energy conversion system

Description
Electrical Generator Modeling - Drive Train Modeling Power Electronics Converters & Grid Modeling – Linearization & Eigen value analysis – Case study – Control of generators in WECS – Control System for Grid
connected operation and Energy Quality Assessment - MPPT strategies – PI, ON/OFF & Sliding mode control – Feedback Linearization & QFT Robust Control. LQ control of WECS – 2LFSP applied to WECS with Rigidly-coupled generator and flexibly-coupled generator - Voltage and Reactive Power Control:

Reference Books

14EE3045 WIND RESOURCE ASSESSMENT AND FORECASTING METHODS
Credits: 3:0:0
Prerequisite: 14EE3014 Wind Energy
Course Objective
• To understand the basics of assessing potential sites for wind farms
• To learn the mathematical basics involved in forecasting of data
• To equip the student with the latest forecasting techniques
Course Outcome
• Ability to understand the technical and economical aspect of wind resource assessment
• Ability to understand the basics of available forecasting models
• Ability to develop accurate forecasting models
Description

Reference Books

14EE3046 TURBINES FOR RENEWABLE ENERGY SYSTEMS
Credits 3:0:0
Course Objective
• To expose the students to different turbines used for renewable energy systems
• To equip the students to design turbines for different power generation schemes
To enable the students to identify any flaws and faults related to turbines and its design

**Course Outcome**
- Clear idea about the turbines, its operation under various conditions.
- Ability to design and develop turbines for different power generation systems
- Ability to bring out finer and more efficient designs for turbines

**Description**

**Reference Books**

**14EE3047 DATA MINING FOR RENEWABLE ENERGY TECHNOLOGY**

**Credits: 3:0:0**

**Course Objective**
- To enlighten the students’ on the basic concepts of data mining.
- To improve the students’ competence in the algorithms and learning schemes of data mining.
- To enable the students to exploit the data mining techniques for research in renewable energy.

**Course Outcome**
- Understand the importance of data-driven performance optimization of renewable energy technology.
- Exploit the vast data base available in the renewable energy sector and devise ways to make renewable energy a competitive source of supply.
- Find the various research opportunities provided by this field.

**Description**
Data Mining, Functionalities, Classification, Primitives, Data Preprocessing, Data Warehousing, Multidimensional Data Model, Data Warehouse Architecture & Implementation, Mining Frequent Patterns, Associations, Mining Multilevel Association Rules - Decision tree Induction, Bayesian Classification, Lazy Learners, Other Classification Methods, Prediction, Accuracy and Error Measures, Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Mining Stream, Time-Series and Sequence Data - Application of Data Mining in Wind Power System, Wind Power Prediction, Modeling and Forecasting of Solar Radiation Data, Analyzing Solar Power Plant Performance.

**Reference Books**
14EE3048 GRID CONVERTERS FOR WIND POWER SYSTEMS

Credits: 3:0:0

Prerequisite: 14EE3012 Power Electronic Circuits
14EE3014 Wind Energy

Course Objective
- To illustrate key concepts about converter structures and grid requirements
- To enlighten the students about the latest power conversion and control technology in photovoltaic and wind power systems
- To provide in-depth understanding about grid synchronization

Course Outcome
The student will be able to
- Know about the stringent grid requirements due to high penetration of renewable energy systems
- Understand the topologies, modulation and control of grid converters for both photovoltaic and wind power applications.
- Understand the advanced functions of grid converters like dynamic control of active and reactive power, voltage ride-through capability, grid services support etc.

Description

Reference Books

14EE3049 OFFSHORE WIND POWER

Credits: 3:0:0

Course Objective
- To have an overview of the complete range of offshore wind issues.
- To understand the fundamental and electrical aspects of offshore wind turbines, regulatory framework, grid integration and market incentives
- To instigate interest in the minds of students to know the advantages and ecological impacts of offshore wind

Course Outcome
The student will be able to
- Know the design optimization of offshore wind to support cheaper installation and hauling, incurring lower project costs to improve profitability.
- Understand the latest technology in offshore wind energy, foundation design and turbine materials
- Deal with on-site complications, mitigate potential problems up-front and know the intricacies of successful installation
Description

Reference Books

14EE3050 WIND POWER IN POWER SYSTEMS

Credits: 3:0:0

Course Objective
- To understand the power system impacts of wind power, technical regulations and interconnections.
- To present the basic concepts of power quality standards for wind turbines
- To address the modeling and control of smart grid renewable energy systems

Course Outcome
The student will be able to
- Understand the technical, economic and safety issues inherent in the integration of wind power in the power system
- Know the basic interconnection issues, electrical design of wind power plant and importance of power system stability
- Understand the necessity of dynamic modeling of wind turbines and smart grid technology.

Description

Reference Books
### Course Objective
- Study the properties of semiconductors
- Understand the need for purity and minimization of crystal imperfections for making high performance solar cells
- Understand the pros and cons of manufacturing methods.

### Course Outcome
The student will
- Be able to describe the uniqueness of different PV cells
- have a good understanding of semiconductors used for PV cell manufacturing
- be able to describe and discuss the making, calibration of different solar cell devices.

### Description

### Reference Books

### 14EE3052 PV SYSTEM DESIGN AND INSTALLATION

#### Credits: 3:0:0

#### Prerequisite: 14EE3011 Photovoltaic Systems

#### Course Objective
- Study the different photovoltaic Energy systems
- Understand the System design procedures
- Know the sizing of different components used in the PV System

#### Course Outcome
The student will
- Be able to calculate the energy demand
- Identify the correct system and its components
- Do the correct sizing procedure for optimal system design

#### Description
An overview of Photovoltaic- Photovoltaic Electric Principles- The solar resource-Photovoltaics and weather-Calculating the solar Energy-Site survey- Electrical Load Analysis-Photovoltaic modules performance-Photovoltaic

Reference Books


14EE3053 MATERIALS FOR SOLAR POWER

Credits 3:0:0

Course Objective

- Study the different materials used in manufacturing process
- Understand the physics of solar cell
- Know the technology of silicon extraction

Course Outcome

- Able to understand the properties and characteristics of materials used in energy applications
- Basic design concepts and technologies for manufacturing the solar cells will be acquired.
- Be familiar about various cell fabrication techniques.

Description


Reference Books

14EE3054 PASSIVE SOLAR ARCHITECTURE

Credits: 3:0:0

Course Objective
- To understand the building laws and architectural design.
- To understand the role of the site selection and its context play in designing a building, with an emphasis on the climate and other environmental conditions.
- To understand the concepts of a comfortable thermal environment and the passive solar design principles, passive ventilation and solar shading to create a comfortable thermal environment.

Course Outcome
- Analyze the site and its context in preparation for designing a building, particularly with respect to climate and other environmental conditions and translate the analysis data into useable design data and design concepts.
- Design and build environments that are both thermally comfortable and thermally delightful by utilizing passive solar design principles.
- Utilize the combined site-specific potentials of sun, light, wind and rain for creating a sustainable, comfortable and delightful built environment.

Description

Reference Books

14EE3055 OCEANIC ENERGY

Credits: 3:0:0

Course Objective
- To provide necessary knowledge about the basics, design and analysis of two important oceanic energy components i.e., tidal and wave.
- To make the learner to understand the operation of tidal power plants and wave power plants
- To impart the basic knowledge about integration of tidal and wave power plants with grid

Course Outcome
- Have awareness about the possibilities of power generation from ocean
- Suggest new mechanisms to harvest energy from ocean
- Design efficient tidal and wave power plants

Description
Historical Development Tidal phenomenon Propagation of tides in estuaries -Coriolis effect -Barrage effects Tidal Schemes Basin Schemes Retiming of tidal energy physiography of the estuary Geology Tides Waves currents Ecosystem characteristics Hydraulic and numerical models Hybrid models Barrier Modeling and effects Utility
system planning and simulation - Civil works Design parameters Dikes Construction schedules Electromechanical equipment generating equipment turbines Transmission Integration of output with electric utility systems considerations - Wave structure Global wave energy potential technologies concentration effects Tapered channel Oscillating water column Mighty whale design Turbines for wave energy Ocean wave conversion system power distribution Grid connection Environmental impacts

**Reference Books**


**14EE3056 GEOTHERMAL ENERGY**

**Credits: 3:0:0**

**Course Objective**

- To develop an in-depth understanding of the issues associated with the development of geothermal energy.
- To make the students to realize the current state of geothermal energy resources and technologies.
- To impart the knowledge of energy analysis applicable to geothermal systems.

**Course Outcome**

- Ability to understand the role which geothermal energy plays in the energy sector
- Gain knowledge regarding the future of geothermal energy resources
- Ability to analyze geothermal energy resources based on energy efficiencies

**Description**

Model of a hydrothermal geothermal resource, Hot dry rock, HDR-Geo pressure Magma energy Phases of an exploration program Synthesis interpretation Geothermal well drilling reservoir well flow testing Calcite scaling in well casings modeling and simulation - Single-Flash Steam power plants Gathering system design considerations Energy conversion system flash plants conversion system Scale potential in waste brine Equipment list flash plants Origins and nature of dry-steam resources Equipment list for dry-steam plants Binary cycle power plants Working fluid selection Hybrid flash systems binary systems Total-flow systems Hybrid fossil Combined heat and power plants Hot dry rock (enhanced geothermal systems) Power plants for hypersaline brines - First law for open, steady systems - Second law for open, steady systems - Exergy - Exergy accounting for open, steady systems - Exergy efficiencies and applications to geothermal plants.

**Reference Books**


**14EE3057 POLICY AND REGULATORY ASPECTS OF RENEWABLE POWER GENERATION**

**Credits 3:0:0**

**Prerequisite:** 14EE3013Energy Engineering

**Course objective**

- Study the policy and regulatory framework to make renewable power generation economically viable.
Understand the problems of high transmission and distribution (T&D) losses, frequent disruption in supply of grid power, practical problems and financial non-viability of the transmission grids. Students will be encouraged to simulate some case studies using RETScreen & HOMER softwares.

Course Outcome
The students will be able to
- know the policy frameworks for various renewable energy sources including distributed and decentralized energy solutions also.
- understand the advantages and challenges associated with the deployment of these technologies.
- evaluate the economical and technical viability of renewable power generation.

Description
Renewable energy credit schemes, Statutory requirements and activities of various states in this regards - Tariff determination issue - National Solar Mission - Regulations regarding grid interconnections of renewable energy systems - Need and advantage of Decentralized energy solutions - Emergence of policy and regulatory framework for decentralized electricity (Gokak Committee report) - Status of grid connected and off grid distributed generation (national and International) - Electrification and off grid status/scenario in India - Scope and challenges in implementing off grid solutions - Policy & regulatory Framework for rural electrification - Relevant policies and frameworks in other countries - Recent off grid programs started by Govt. of India for enhancing the rural electrification through off-grid solutions - DDG scheme under Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) - DDG scheme under Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) - Remote Village Electrification Program - Village Energy Security Program (VES) - Off grid Program under JNNSM.

Reference Books:
3. Best practices of the Alliance for Rural Electrification: what renewable energy can achieve in developing countries; Alliance for Rural Electrification.

Journals and Magazines:
1. The Zambian ESCO project.
2. Sunlight Power Maroc (Morocco).
4. Off grid solutions applied in various parts of India (e.g. LaBL- SMU, NTPC DDG, VESP, DESI Power, Husk Power, etc).
5. SHP in Nepal and Sri Lanka
6. IDCOL/Grammen Shakti model in Bangladesh

14EE3058 NUCLEAR ENGINEERING

Credits 3:0:0

Course Objective
- Get knowledge on Nuclear reaction materials and various reprocessing techniques.
- Understand the nuclear waste disposal techniques and radiation protection aspects.
- Awareness on future nuclear reactor systems with respect to generation of energy, fuel breeding, incineration of nuclear material and safety.

Course Outcome
The students will be able to
- know in detail about the fundamentals of nuclear reactions.
• understand nuclear fuels cycles, characteristics, fundamental principles governing nuclear fission chain reaction and fusion and kinetics.
• select the appropriate type of nuclear materials and preprocessing methods for power generation.

Description

Reference Books

14EE3059 HYDRO POWER TECHNOLOGY

Credits 3:0:0

Course objective
• Understand the basic concepts of aerodynamics, horizontal and vertical axis wind turbines, small hydro system components and design
• Know economical and electrical aspects of Small, mini and micro hydro turbines.
• Study about the selection, testing and governing of turbines.

Course Outcome
The students will be able to
• prepare a detailed report and plan for the construction of hydro power plant.
• develop prototype hydro systems.
• select and analyze the particular turbine for specific need.

Description

Reference Books:
14EE3060 DESIGN AND DEVELOPMENT OF WIND TURBINES

Credits: 3:0:0

Course Objective
- To introduce the concepts dynamics and acoustics of wind turbines
- To enlighten the students about the latest technologies for turbine design
- To provide in-depth understanding about the challenges in wind power generation

Course Outcome
The student will be able to
- Design and develop wind turbines of different rating
- Understand the aerodynamic and structural aspect of wind turbines.
- Understand the recent technological advancements in wind turbine design

Description

Reference Books

14EE3061 CONTROL AND DRIVES FOR SOLAR SYSTEMS

Credits 3:0:0

Course Objective
- To familiarize students with the concepts of control and drives and importance of embedded system
- To implement the control system for solar energy applications
- To Understand the advanced controls of solar plant

Course Outcome
The student will be able to understand and apply
- The basic concepts of process control and controllers.
- Electronic realization of controllers.
- Advanced controls in solar plants

Description
Controller Principles: Basic concepts of process control, discontinuous and continuous mode operation. Introduction to proportional, integral and derivative control. Design, characteristics and response of controllers. Electronic Realization, Selection of controllers, need for process controller, controller tuning and evaluation criteria. P/I and I/P converters. Model Representation: Introduction to MATLAB, matrix operation, different graphical output,
integration and solution to differential equation. Types of error - Convergence and stability. Models of electro-mechanical system, solar photo voltaic cell and DC motor. Transient and steady state response of system, Simulation, Embedded System and Applications, Control of solar plants: Model based predictive control strategies, frequency domain control and robust optimal control. Introduction to fuzzy logic control and LABVIEW

Reference Books

14EE3062 LOGIC CONTROLLERS FOR AUTOMATION

Credits 3:0:0

Course Objective
- To understand the fundamentals of various automation methods.
- To understand the types of PLC and its working.
- To understand the various control modules and memory concept of S7-300/400.
- To understand the wiring of I/O modules

Course Outcome
- Differentiate various PLCs and their features based on their application.
- Setup a PLC station with consistency.
- Develop SIMATIC Manager project.

Description

Reference Books

14EE3063 HMI SYSTEMS

Credits 3:0:0

Corequisite: 14EE3064 PLC Applications & Industrial Communication

Course Objective
- To understand the purpose and classification of HMI.
- To understand the concept of Tags and to do Tag management.
- To understand the features of HMI and to use them.
- To understand the “Totally Integrated” Engineering
Course Outcome
  • Choose licenses based on tag requirement.
  • Design and implement HMI – PLC connection.
  • Configure Server-Client configuration for HMI Panels.

Description

Reference Books

14EE3064 PLC APPLICATIONS & INDUSTRIAL COMMUNICATION

Credits 3:0:0

Course Objective
  • To understand the programming of PLC in different languages.
  • To understand the advanced programming concepts.
  • To understand the configuration of different communication possibilities for PLC.

Course Outcome
  • Full end programming of PLC.
  • Design and implement Master-Slave Communication.
  • Design and implement Master-Master Communication
  • Utilize all major engineering tools in the software.

Description

Reference Books
1. SITRAIN Training Manual, “TIA Advanced with S7-300/400”, V1.0.
14EE3065 INDUSTRIAL DC DRIVES

Credits 3:0:0

Course Objective
- To understand the fundamentals of various electromechanical systems.
- To understand the basic concept of DC Drives.
- To understand the various control techniques involved with DC Drives.

Course Outcome
- Design and Analyze different control techniques of DC Drives.
- Select suitable DC Drive for different requirements
- Apply appropriate control method for the application.

Description
Power Electronics (Thyristors, Power Transistors) - DC Machines: Separately Excited Motors (Constructions, Operations, Power, Applications) - Series Motors (Introduction) - Shunt Motors (Introduction) - Compound Motors (Introduction) - DC Drives: Thyristorized Drive for Separately Excited Motors - Single/Four Quadrant operations in DC Drives - DC Drives options, features, systems & configurations - DC Drives selections & applications

Reference Books

14EE3066 INDUSTRIAL AC DRIVES

Credits 3:0:0

Course Objectives
- To understand various operating regions of the induction motor drives.
- To study and analyze the operation of VSI & CSI fed induction motor control.
- To understand the speed control of induction motor drive from the rotor side.
- To understand the field oriented control of induction machine.
- To understand the control of synchronous motor drives.

Course Outcome
- Design and Analyze different control techniques of AC Drives
- Select suitable AC Drive for different requirements
- Apply appropriate control method for the application

Description
Power Electronics (IGCT & IGBT) - AC Machines - Synchronous Machines (Constructions, Operations, Power, Applications) - Asynchronous Machines (Constructions, Operations, Power, Applications) - Special Machines (Introductions) - AC Drives - IGBT/IGCT based AC Drive for Induction Motors - Single/Four Quadrant operations in AC Drives - AC Drives options, features, systems & configurations - AC Drives Braking Methods - AC Drives selections & applications - AC Drives for Synchronous Motors

Reference Books

14EE3067 DATA LOGGING AND VISUALIZATION

Credits 3:0:0

Corequisite: 14EE3064 PLC Applications & Industrial Communication

Course Objective
- To understand the features and architecture of SCADA.
- To understand the designing of SCADA animations, alarms, data logs etc.
- To understand the user authorizations possible for SCADA objects.

Course Outcome
- Design and animate process simulation.
- Configure Alarms, Trends, Data logs etc.
- Assign access rights and control to runtime project.

Description

Reference Books
3. Gordan Clark, Deem Reynders, Practical Modern SCADA Protocols, Newnes Publisher, 2004

14EE3068 ADVANCED SCADA APPLICATIONS

Credits 3:0:0

Prerequisite: 14EE3064 PLC Applications & Industrial Communication
14EE3067 Data Logging and Visualization

Course Objective
- To understand the multi-computer architecture of SCADA.
- To understand the purpose and configuration of Redundant SCADA station.
- To understand the “TIA Engineering” in SCADA.
Course Outcome
- Configure Server-client architecture for SCADA.
- Configure Server Redundancy.
- Integrate SCADA into Step7.

Description

Reference Books
4. Gordan Clark, Deem Reynders, Practical Modern SCADA Protocols, Newnes Publisher, 2004

14EE3069 LOW VOLTAGE SWITCHGEAR

Credits 3:0:0

Course Objective
- To understand the switchgear and control gear (LV).
- To understand different types of fuse.
- To understand the Motor starter.

Course Outcome
- Knowledge on maintenance of MCCB.
- Use available accessory fitting on ACB.
- Knowledge on maintenance of ACB.

Description
Low-voltage control gear and switchgear - overview of products-Products Covered -ACBs - Basics , ETU settings , Hands On practice required for maintenance-MCCBs - Basics , ETU settings-Contactors, Bi-relays, Electronic relays, MPCBs, Sirius series-SDFs, Fuses-Introduction of Smart Motor Starters-Basic principles, construction and functions, selectivity, back-up protection, switching duties, protection classes-Product selection methods -Benefits for the customer, applications and solutions -Accessory fittings and hands-on training on ACB-Maintenance methods on ACB.

Reference Books

14EE3070 DISTRIBUTED CONTROL SYSTEM

Credits 3:0:0

Prerequisite: 14EE3064 PLC Applications & Industrial Communication
14EE3067 Data Logging and Visualization

Course Objective
- To understand DCS architecture.
To understand the designing of DCS project and programming.
To understand AS-OS interconnection in DCS.

Course Outcome
- Design and implement Process Control System.
- Programming with CFC Chart.
- Create OS objects by chart compiling
- Monitor and Control process parameters from OS.

Description

Reference Books

14EE3071 AUTOMATION LABORATORY I

Credits 0:0:2
Prerequisite: 14EE3064 PLC Applications & Industrial Communication
14EE3063 HMI Systems

Course Objective
- To understand the project creation and programming of PLC.
- To understand different programming languages of PLC.
- To understand configuration and design of screens in HMI.

Course Outcome
- Design, program and automate machines/process.
- Design and implement Master-Slave and Master-Master communication.
- Establish communication with HMI Panels and show status of PLC in HMI.

Description
This laboratory enables the students to automate a machine/process using PLC. It also makes them implement necessary communication and to show the process status in a HMI Panel.

14EE3072 AUTOMATION LABORATORY II

Credits 0:0:2
Prerequisite: 14EE3066 Industrial AC Drives
14EE3068 Advanced SCADA Applications
14EE3069 Low Voltage Switchgear
Course Objective

- To understand the parameterization and operation of a Drive.
- To understand features and design of SCADA system.
- To understand use and working of switchgear components.

Course Outcome

- Commission a SINAMICS G120 drive with or without Starter software.
- Control the operation of a Drive using PLC.
- Design and animate complete process using SCADA systems.

Description

This laboratory makes the students to commission and parameterize a Drive for standalone operation as well as to be controlled by a Master PLC. In addition, it makes them do the data logging and visualization of a complete process with a SCADA station.

14EE3073 MODELING AND SIMULATION OF DYNAMIC SYSTEMS

Credits 3:0:0

Course Objectives:

- To understand state space representation of different systems.
- To understand system modeling and simulation through bond graphs

Course Outcomes:

- Analyze stability, controllability and observability of a given system.
- Modeling and simulation with incomplete knowledge sensor modeling.
- Differentiate thick and thin film modelling

Description


Reference Books

7. Patranabis, D.- Sensors and Transducers. 2nd edition, PHI, New Delhi,
14EE3074 DISTRIBUTION AUTOMATION

Credits 3:0:0

Course Objective
- To understand the purpose of Automation in Power Distribution.
- To understand the communication methodologies used in power distribution automation.
- To understand the methods for study and analysis of power distribution systems.

Course Outcome
- Configure communication for DA.
- Transfer data to management using Management Information System (MIS).
- Formulate estimation equations.

Description

Reference Books