

ELECTRICAL POWER GENERATION SYSTEMS

IV Semester: EEE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEEB15	Core	L	T	P	C	CIA	SEE	Total
		3	1	-	4	30	70	100
Contact Classes: 45		Tutorial Classes: 15		Practical Classes: Nil			Total Classes: 60	

OBJECTIVES:

The course should enable the students to:

- I. Demonstrate various conventional power generation systems including major subsystems.
- II. Understand hydroelectric power generation systems along with pumped storage plants and hydraulic turbines.
- III. Apply knowledge of solar and wind power generation systems in design and implementation to obtain clean energy.
- IV. Illustrate the economic aspects of power generation and power tariff methods

COURSE OUTCOMES (COs)

- CO1:** Discuss the principles and operation of thermal and nuclear power plants.
CO2: Demonstration of working of hydro power plant and its importance in the power system.
CO3: Describe the principle, operation of photovoltaic effect and layout of solar power plant.
CO4: Discuss the construction and working principle of wind energy systems.
CO5: Explain about economic aspects of power generation.

COURSE LEARNING OUTCOMES (CLOs)

At the end of the course, the student will have the ability to:

1. Demonstrate the layout and working principle of thermal power plant.
2. Analyze the principle and operation of different energy conversion systems.
3. Discuss the principles and operations of nuclear power plant.
4. Discuss about different types of turbines.
5. Explain about various hydro power plants.
6. Explain the working of hydro power plant and its importance in the power system.
7. Discuss the principles and operations of photovoltaic effect.
8. Describe the layout and working of solar power plant in electrical systems.
9. Build the flow chart of maximum power point tracking system.
10. Demonstrate the importance of wind energy system and types of turbines.
11. Demonstrate the construction and working principle of wind energy systems.
12. Discuss the principle and operation of induction generator in wind energy system.
13. Discuss about different loads and their importance.
14. Explain about different factors which are affecting cost of generation.
15. Demonstrate different tariffs in power systems.

MODULE - I	CONVENTIONAL POWER GENERATION SYSTEMS	Classes: 09
<p>Thermal Power Stations: Evaluation of power systems, present day scenario, Line diagram of thermal power station (TPS) showing paths of coal, steam, water, air, ash and flue gasses; Brief description of TPS components: Economizers, boilers, super heaters, turbines, condensers, chimney and cooling towers. Nuclear power stations: Nuclear fission and chain reaction, nuclear fuels, principle of operation of nuclear reactor, reactor components, moderators, control rods, reflectors and coolants, radiation hazards, shielding and safety precautions, types of nuclear reactors and brief description of PWR, BWR and FBR; Gas power stations: Principle of operation and components (Block diagram approach only).</p>		
MODULE - II	HYDROELECTRIC POWER STATIONS	Classes: 09
<p>Hydroelectric Power Stations: Elements of hydro electric power station, types, concept of pumped storage plants, storage requirements, mass curve (explanation only), estimation of power developed from a given catchment area, heads and efficiencies; Hydraulic turbines: Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine, working proportions, work done, efficiencies, hydraulic design, draft tube theory, functions and efficiency.</p>		
MODULE - III	SOLAR ENERGY	Classes: 09
<p>Solar radiation: Environmental impact of solar power, physics of the sun, solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on tilted surface, instruments for measuring solar radiation, solar radiation data, solar concentrators, collectors, thermal applications, design of standalone solar systems, simple problems. Photovoltaic systems: Photovoltaic effect, semiconducting materials, band gap theory, photo emission of electrons, cell configuration, types of solar cells, cell properties, device physics, electrostatic field across the depletion layer, voltage developed, I-V characteristics, module structure and fabrication, output power and efficiency, fill factor, maximum power point tracking (MPPT), solar grid connected inverters, simple problems.</p>		
MODULE - IV	WIND ENERGY	Classes: 09
<p>Wind energy: Sources and potential, power from wind, Betz criterion, components of wind energy conversion system, types of turbines, horizontal and vertical axis wind turbines, aerodynamics, operational characteristics, blade element theory, types of generating systems for wind energy, permanent magnet generators, DC generators, induction generators, doubly fed induction generators, applications of wind energy, safety and environmental aspects, simple problems.</p>		
MODULE - V	ECONOMIC ASPECTS OF POWER GENERATION	Classes: 09
<p>Terms commonly used in system operation, various factors affecting cost of generations; load curves, connected load, maximum demand, peak load, base load and peak load power plants, load factors, plant capacity factor, plant use factor, demand factors, diversity factor, cost of power plant, tariffs.</p>		
Text books		
<ol style="list-style-type: none"> 1. C L Wadhawa, "Generation, Distribution and Utilization of Electrical Energy", New Age International Limited, New Delhi, 3rd Edition, 2005 2. G D Rai, "Non-Conventional Energy Sources", Khanna Publishers, 1st Edition, 2011. 3. G N Tiwari, M K Ghosal, "Fundamentals of Renewable Energy Sources", Narosa Publications, New Delhi, 1st Edition, 2007. 4. Chetan Singh Solanki, "Solar Photovoltaics", PHI Publications, 2nd Edition, 2011. 5. M L Soni, P V Gupta, U S Bhatnagar and A Chakraborti, "A text book on Power system engineering", Dhanpat Rai and Co. Pvt. Ltd, 1999. 		
References		
<ol style="list-style-type: none"> 1. J B Gupta, "A Course in Electrical Power", S K Kataria and Sons, New Delhi, 15th Edition, 2013. 2. M V Deshpande, "Elements of Power Station Design", Prentice Hall Learning Private Limited New Delhi, 1st Edition, 1992. 3. Mukund R Patel, "Wind and Solar Power Systems", CRC Press, 1st Edition, 1999. 4. V K Mehta and Rohit Mehta, "Principle of Power Systems", S Chand & Company, Ltd, New Delhi, 3rd Edition, 2005. 		