ELECTRICAL POWER GENERATION SYSTEMS

IV Semester: EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEEB14	Core	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

Students will try to learn:

I. The fundamental concepts of power generation and gain knowledge about the different renewable and non-renewable energy sources.

II. Thorough theory on the construction and working principle of thermal, hydro-electric, nuclear and gas power plants.

III. The key aspects in solar and wind power energy systems and analyze their environmental aspects in the present-day scenario to obtain clean energy.

IV. The various factors affecting cost of generations and the different Tariff methods for electrical energy consumption to attain optimum utilization of generated electrical energy.

V. The ability to incorporate the knowledge of electrical power generation in working with minor and major projects and to take up research work in future.

COURSE OUTCOMES:

Upon the successful completion of this course, the students will be able to:

CO1 **Explain** the operating principle of thermal power station (TPS) to evaluate the significance of TPS.

CO2 **Identify** different energy conversion systems with respect to its working principle, merits and demerits.

CO3 **Explain** the operating principle of nuclear power station (NPS) for analyzing the importance of NPS in the field of power generation and environmental aspects.

CO4 **Elucidate** the working principle and layout of hydroelectric power station (HPS) along with its multi-purpose.

CO5 **Interpret** the efficiency of different turbines used in hydroelectric power stations.

CO 6 **Paraphrase** the solar power generation using photovoltaic effect and its applications.

CO 7 **List out** various instruments used for measuring diffuse and direct solar radiation.

CO 8 **Develop** the flow chart for maximum power point tracking system of solar cell to capture maximum energy from sun radiation.

CO 9 **Explain** the working principle of wind energy system (WES), types of turbines and the importance of WES.

CO 10 **Summarize** the performance of different generators used in wind energy systems.

CO 11 **Interpret** the effect of role of tariff on the cost of power generation.

CO 12 **Work with a small team** to build prototype models of renewable energy sources to obtain clean and green energy.

MODULE-I	CONVENTIONAL POWER GENERATION SYSTEMS	Classes: 09
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).		
MODULE-II	**HYDROELECTRIC POWER STATIONS**	**Classes: 09**
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.		
MODULE-III	**SOLAR ENERGY**	**Classes: 09**
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.		
MODULE-IV	**WIND ENERGY**	**Classes: 09**
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.		
MODULE-V	**SINGLE-PHASE INDUCTION MOTORS**	**Classes: 09**
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.		

Text Books:

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

Reference Books:

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.

Web References:

1. https://www.electrical4u.com
2. https://www.freevideolectures.com

E-Text Books:

1. https://www.freeengineeringbooks.com
2. https://www.pdfdrive.com/textbook-of-electrical-technology-ac-and-dc-machines-d184089760.html