



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

POWER GENERATION SYSTEMS AND ECONOMIC ASPECTS								
III Semester: EEE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEED11	Core	3	0	0	3	40	60	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 48			
Prerequisite: Nil								

I. COURSE OVERVIEW:

This course provides ability to recognize, analyze and troubleshoot different elements in electric power generation systems. It deals with conventional energy systems like thermal and nuclear power stations. This course also introduces non-conventional energy systems like solar energy (radiation, collection, storage, and application), Hydro and Wind energy. This course will also discuss some environmental impacts of power generation and also look at alternative and sustainable energy resources.

II. COURSE OBJECTIVES:

The 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.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

- CO1 Demonstrate the knowledge about the electric power generations and their impacts.
- CO2 Assess the theory and practices of conventional and non-conventional power generation generation method.
- CO3 Determine the operation, maintenance and working of power plants.
- CO4 Aware of the principle of operation, components, layout, location, environmental and social issues of nuclear, diesel and gas power plant.
- CO5 Interpret the effect of role of tariff on the cost of power generation.

IV. COURSE CONTENT:

MODULE-I: Sources of Electrical Power (09)

Wind, solar, fuel cell, tidal, geo-thermal, hydro-electric, thermal-steam, diesel, gas, nuclear power plants (block diagram approach only). Concept of co-generation. Combined heat and power distributed generation. Diesel electric plants. Gas turbine plants. Mini, micro, and bio generation. Concept of distributed generation.

MODULE-II: Hydro Power Generation Thermal Power Generation (09)

Hydro Power Generation: Selection of site. Classification of hydro-electric plants. General arrangement and operation. Hydroelectric plant power station structure and control. Thermal Power Generation: Introduction. Main

parts of a thermal power plant. Working. Plant layout. Pros and cons of nuclear power generation. Selection of site, cost, components of reactors. Description of fuel sources. Safety of nuclear power reactor.

Module-III: Solar Energy (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 (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, momentum theory (actuator disk concept), operational characteristics, blade element theory, types of generating systems for wind energy.

Module-V: Economic Aspects of Power Generation (09)

Economics Aspects: Introduction. Terms commonly used in system operation. Diversity factor, load factor, plant capacity factor, plant use factor, plant utilization factor and loss factor, load duration curve. Cost of generating station, factors influencing the rate of tariff designing, tariff, types of tariff. Power factor improvement.

V. 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.

VI. 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 India 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.

VII. ELECTRONICS RESOURCES:

1. <https://www.solarpowernotes.com>
2. <https://www.electrical4u.com/power-plants-types-of-power-plant>
3. <https://www.iare.ac.in>

VIII. MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech talk topics

4. Open end experiments
5. Definitions and terminology
6. Assignments
7. Model question paper - I
8. Model question paper - II
9. Lecture notes
10. E-learning readiness videos (ELRV)
11. Power point presentation