

ssSemester – III
Subject Name: Generation of Electrical Power
Subject Code: 09EE3302
Diploma Branches in which this subject is offered: Electrical Engineering

Objective: To develop understanding of electrical power generation from conventional and non-conventional sources, including plant operation, layout, and energy conversion, and to equip students with skills for efficient, safe operation and problem-solving in modern power plants.

Credits Earned: 4 Credits

Course Outcomes: After completion of this course, student will be able

1. Apply concepts of electrical energy demand, generation, sources, and growth trends in power systems.
2. Analyze working principles, design, and performance of conventional power plants.
3. Analyze working principles, design, and applications of non-conventional power plants.
4. Evaluate power plants based on performance, safety, and environmental impact.

Pre-requisite of course: Basic knowledge of D.C. and A.C. Circuits.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE	IA	CSE	Viva	Term work	
3	1	0	4	50	30	20	25	25	150

Contents:

Unit	Topics	Contact hours	Weightage (%)
1	Basic of Generation and Steam Power Plant Basics of Generation • Introduction • Important and demand of electrical energy • Generation of electrical energy • Source of energy • Growth of power systems in India • Electrical energy losses	11	26



	• Power crises in India, Future trends and demands • Organization of power sector in India • Private sector in energy management and captive power plants • Indian electricity Grid code • Transport of fuel and electricity Steam Power Plant • Introduction • Energy conservation principle and process • Selection of site, • Main flow circuits: Fuel and Ash circuit, Air and Gas circuit, Feed water and Steam circuit, Cooling water circuit • Function of major equipment and auxiliaries • Plant layout • Efficiency of thermal power station: Thermal efficiency and overall efficiency • Advantages and disadvantages of thermal power station • Important terms and factors related to generating station • Various types of load, Load curve and load duration curve • Important terms and factor: Average demand, Maximum demand, Load factor, connected load, demand factor, diversity factor, coincidence factor, loss factor, plant capacity factor, plant use factor, utilization factor etc • Numerical based on above topics • Base load and peak load station • Safety precaution to be taken in plant • Pollution generated by steam power plant • Draught systems, Steam power plant control • Major steam power plant in India and Gujarat		
2	Hydro Power Plant • Introduction • Energy flow process • Merits and demerits • Selection of site • Constituents of hydro-electric power station: Hydraulic structure, Water Turbines, Electrical equipment • Different schemes of hydro-electric power station: High head, medium head, low head • Hydroelectric generator and compare it's with steam power plant	06	14

	• Choice of size and number of generating units • Plan layout • Environmental impacts • Major hydroelectric power station		
3	Nuclear Power Plant • Introduction • Energy flow process, Location of nuclear power plants • Merits and demerits • Selection of site • A brief review of nuclear energy, Nuclear fuels • Types of radiations • Nuclear fusion and fission, Nuclear chain reaction • Nuclear reactor-main parts and their function • Reactor control and coolant, Classification of nuclear reactor • Schematic diagram of nuclear power plant and plant layout • Disposal of nuclear waste and effluent • Safety precaution to be taken in nuclear power plants • Comparison of heat obtained from burning of coal and nuclear fission • Comparison between steam power plant and nuclear power plant • Major nuclear power plants	04	10
4	Solar Power Plant • Introduction • Solar energy and its merits and demerits • Application of solar energy • Solar radiation and constant • Term related with solar radiation, Measurement of solar radiation • Utilization of solar energy • Types of solar energy collectors • Solar thermal power generation • Solar photovoltaic power generation • Block diagram of solar photovoltaic system • Solar Photovoltaic (PV) power plant: components layout, construction, working. • Rooftop solar PV power system: Grid connected and Standalone • Advantage, disadvantage and application of solar PV system • Solar cell and it's types, Advantage,	8	19

	disadvantage and application of solar cell • Terms regarding solar power plant • Safety precaution to be taken in solar power generation • Major solar power generation units		
5	Wind Power Plant • Introduction • Wind energy • Energy flow in wind power generation • Merits and limitations of wind power generation • Instruments for measuring wind speed and direction • Wind farms • Wind turbine, Types of wind turbine, Types of rotor used for wind turbine, Principle of rotation of wind turbine, Aerodynamic control of wind turbine, • Important terms regarding wind power generation: Wind turbine efficiency, swept area, cut in wind speed, rated wind speed, cut out wind speed • Wind power generation plants, Block diagram of wind power plant • Wind turbine types (HAWT and VAWT) and their construction • Schemes for electrical power generation • Types of wind power plants based on gear system • Schemes of electric generation: Constant speed constant frequency, Variable speed constant frequency, variable speed variable frequency • Future and development of wind power generation • Safety precaution to be taken during installation and maintenance of wind turbine • Major wind power generation units	7	17
6	Non-Conventional Power Plant • Introduction • Captive power plant • Diesel electric power plant • Gas based power plant • Geothermal power generation • Ocean energy • Biomass energy • Fuel Cell: Principle of electricity generation, Types	06	14

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyse	Evaluate	Create
40%	45%	5%	10%	0%	0%

Suggested List of Tutorials:

Sr. No.	Unit No.	Name of Topics	Contact Hours
1	1	Prepare a study report on routine maintenance parts of the thermal power plant after watching video Programme.	3
2	2	Prepare a study report on routine maintenance parts of the hydro power plant after watching a video programme.	2
3	3	Prepare a study report on routine maintenance parts of the nuclear power plant after watching video programme.	2
4	4	Prepare a report on classification of solar power generation.	2
5	5	Prepare a report on HAWT and VAWT.	2
6	6	Prepare a report on assemble and dismantle of small biogas power plant.	2

Instructional Method:

- The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

- e. Show video or animation of working of various types of power generation stations

References:

1. J. B. Gupta, "A Course Power Systems", S. K. Kataria & Sons, 2017
2. B. R. Gupta, "Generation of Electrical Energy", S. Chand Publishing, 2014
3. V.K. Mehta and Rohit Mehta, "A Principles of Power System", S. Chand Publishing, 2014
4. A. Chakrabarti, "A Textbook on Power System Engineering", Dhanpat Rai & Co. LTD., 2014.
5. S. Sivanagaraju, "Generation and Utilization of Electrical Energy", Pearson, 2010
6. S. Sivanagaraju, "Electricity Generation Using Wind Power", Pearson, 2010
7. Li Zhang and W. Shepherd, "Theory and Performance of Electrical Machine", World Scientific, 2011
8. Chetan Singh Solanki, "Solar Photovoltaics : Fundamentals, Technologies and Applications", PHI, 2012
9. Chetan Singh Solanki, "Renewable Energy Technologies: A Practical Guide For Beginners ", PHI, 2010

Supplementary Resources:

1. <https://powermin.nic.in/en/content/generation-capacity>
2. <https://posoco.in/>
3. <http://www.sldcguj.com/RealTimeData/RealTimeDemand.php>
4. <https://mnre.gov.in/>
5. <http://www.ntpc.co.in/>
6. <http://www.nhpcindia.com/home.aspx>
7. <http://www.npcil.nic.in/Content/Hindi/index.aspx>
8. <http://www.gsecl.in/>
9. <http://nptel.ac.in/courses/108102047/>
10. <http://nptel.ac.in/courses/108105058/9>
11. <http://nptel.ac.in/courses/108105053/2>
12. <http://www.powermag.com/>
13. <https://www.smartpowergeneration.com/>
14. <https://www.beeindia.gov.in/>