



Semester – III

Subject Name: Generation of Electrical Power

Subject Code: 09EE2302

Diploma Branches in which this subject is offered: Electrical Engineering

Objective: This is one of the core subject of electrical engineering. After studying subject students should be understand the basic concept of generation of electrical power for highly effective working as a skilled electrical engineer in modern power industry. This subject teach to students generation of electricity using steam, hydro, nuclear, solar, wind, gas, diesel, geothermal and other non-conventional energy sources. Modern electrical power generation plant required of highly skilled engineer for installation, commissioning, operation, maintenance and testing of various auxiliary and major equipments installed in plant. To solve the problem of various power plant by using the knowledge of fundamental concept of operation, layout of plant, energy conversion, energy efficiency. Also included various safety precautions required to be followed by engineer and worker during construction, installation, operation and maintenance of various power plants.

Credits Earned: 4 Credits

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

1. To understand basic concept of demand, generation, growth of electrical energy, type of source of energy, power crises, future trends and role of power sector organization.
2. To understand energy conversion principle, working, construction, lay-out, machinery required, merit & demerit and importance of various conventional.
3. To understand energy conversion principle, construction, lay-out, machinery required, merit & demerit and importance of various non-conventional power plants.
4. To analyse and understand working of conventional and non-conventional power plants.
5. To understand importance of safety precaution during working in power plants and environmental issues of various power generation plants

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	0	2	4	50	30	20	25	25	150



Contents:

Unit	Topics	Contact hours	Weightage (%)
1	Basic of Generation and Steam Power Plant Basics of Generation <ul style="list-style-type: none">• Introduction• Important and demand of electrical energy• Generation of electrical energy• Source of energy• Growth of power systems in India• Electrical energy losses• 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 <ul style="list-style-type: none">• Introduction• Energy conservation principle and process• Selection of site, Working diagram and various circuits• Function of major equipment and auxiliaries• Plant layout• Efficiency, Merits and demerits• Turbo-alternator cooling and lubrication system• Important terms and factors related to generating station• Various types of load, Load curve and load duration curve• Base load and peak load station• Units selection and operating schedule based on load curve• 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	11	26
2	Hydro Power Plant <ul style="list-style-type: none">• Introduction• Energy flow process• Merits and demerits• Selection of site• General arrangement, Classification of hydro power plants• Elements and auxiliaries of hydro power plants	06	14



	<ul style="list-style-type: none">• Water turbines, Governing and selection of water turbines• Types of hydro power plants• Hydro electric generator and compare it's with steam power plant• Choice of size and number of generating units• Plan layout• Environmental impacts• Major hydroelectric power station		
3	Nuclear Power Plant <ul style="list-style-type: none">• 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 <ul style="list-style-type: none">• 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• Types of solar PV system• Advantage, disadvantage and application of solar	8	19



	<p>PV system</p> <ul style="list-style-type: none">• Solar cell and it's types, Advantage, 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	<p>Wind Power Plant</p> <ul style="list-style-type: none">• 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 related to wind turbine• Wind power generation plants, Block diagram of wind power plant• Classification of wind power plants• Schemes for electrical power generation• Types of wind power plants based on gear system• Electrical generators used for wind power plants• 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	<p>Non-Conventional Power Plant</p> <ul style="list-style-type: none">• Introduction• Captive power plant• Diesel electric power plant• Gas based power plant• Geothermal power generation• Ocean energy• Biomass energy• Other non-conventional energy sources power generation	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 Practicals:

Sr. No.	Unit No.	Name of Topics	Contact Hours
1	1	Prepare report on important and demand of electrical energy, sources of energy, growth of power generation in India, power crises in India, future trends of power generation and Organization of power sector in India and Gujarat.	4
2	1	Identify the routine maintenance parts of the coal and gas fired thermal power plant after watching a video programme.	3
3	1	Study about cooling and lubrication system of Turbo-alternation with its working flow after watching a video programme.	2
4	2	Identify the routine maintenance parts of the large and micro hydro power plant after watching a video programme.	3
5	2	Understanding of assembles a micro hydro power plant and then dismantle it after watching a video programme.	2
6	3	Identify the routine maintenance parts of the nuclear power plant after watching a video programme.	2
7	4	Understanding of assemble and dismantle the parabolic trough or parabolic dish Concentrated Solar Power (CSP) plant after watching a video programme.	2
8	4	Understanding of assembles the solar PV plant to produce electric power and then dismantle it after watching a video programme.	2



9	5	Identify the routine maintenance parts of the large wind power plant after watching a video programme.	2
10	5	Identify the routine maintenance parts of the horizontal and Vertical axis small wind turbine after watching a video programme.	2
11	6	Understanding of assemble and dismantle a small diesel generator power plant after watching a video programme.	2
12	6	Understanding of assemble and dismantle a small biogas plant to generate electric power.	2

Instructional Method:

- a. 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.
- b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- d. 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. <https://www.youtube.com>
9. <http://www.gsecl.in/>
10. <http://nptel.ac.in/courses/108102047/>
11. <http://nptel.ac.in/courses/108105058/9>
12. <http://nptel.ac.in/courses/108105053/2>
13. <http://www.powermag.com/>
14. <https://www.smartpowergeneration.com/>
15. <https://ioemsre.wordpress.com/2009/06/05/conventional-and-non-conventional-sources-of-renewable-energy/>