



Semester – III

Subject Name: Generation of Electrical Power

Subject Code: 09EE1302

Diploma Branches in which this subject is offered: Electrical Engineering

Objective: This is one of the core subject of electrical engineering. After studying this students should be able to 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 electrical power using steam, hydro, nuclear, solar, wind, gas, diesel, geothermal and other non-conventional energy sources. These type of electrical power generation plant required of highly skilled engineer for operation and maintenance of various auxiliary and major equipments working in plants. To solve the given problem by using the knowledge of fundamental concept of operation, layout of plant, energy conversion, energy efficiency and various equipment available in various plants. 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: 5 Credits

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

1. To understand basic concept of demand, generation and growth of electrical energy
2. To understand type of source of energy, power crises, future trends and role of power sector organization.
3. To understand energy conversion principle, working, construction, lay-out, machinery required, merit & demerit and importance of various conventional and non-conventional power plant.
4. To analyse steam power plant, nuclear power plant and hydro power plant.
5. To analyse various non-conventional power plants.
6. To understand importance of safety precaution during working in power plants and environmental impacts of various power generation plants
7. To analyse and understand working principle, auxiliary, available resources, and advantage of solar and wind power generation.

Pre-requisite of course: Basic knowledge of D.C. Circuits 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	
4	2	0	5	50	30	20	25	25	150



Contents:

Unit	Topics	Contact hours	Weightage (%)
1	Introduction <ul style="list-style-type: none">• Introduction• Important and demand of electrical energy• Superiority of electrical energy• Main parts of a power system• Generation of electrical energy• Source of energy and it's efficiency• Comparison of source of energy• Power to progress• Major electrical equipment in power system• Source of energy in India• 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• Combined operation of power stations• Non-conventional methods of power generation• Indian electricity Grid code	05	9
2	Steam Power Plants <ul style="list-style-type: none">• Introduction• Energy conservation principle and process in steam power plants• Selection of site for steam power plants, uses, trends• Working diagram of steam power plants• Various cycles/circuits of steam power plant• Function of major equipment and auxiliaries used in steam power plant• Plant layout of steam power plant• Efficiency of steam power plant• Merits and demerits of steam power plant• 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	11	19



	<ul style="list-style-type: none">• 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		
3	Hydro-Electric Power Plants <ul style="list-style-type: none">• Introduction• Role of hydro-electric stations in power industry• Energy flow process in hydro power plant• Merits and demerits of hydroelectric power plants• Selection of site for hydroelectric power plants• Hydrology• General arrangement of a hydroelectric plant• Classification of hydroelectric power plants• Elements of hydroelectric power plants• Water turbines• Governing and selection of water turbines• Types of hydroelectric power plants• Hydro potential in India• Hydroelectric generator and compare it's with steam power plant• Choice of size and number of generating units• Plan layout of hydroelectric power plant• Auxiliaries used in hydroelectric power plants• Environmental impacts of hydroelectric power plants• Major hydroelectric power station in India and Gujarat	09	16
4	Nuclear Power Plants <ul style="list-style-type: none">• Introduction• Energy flow process in nuclear power plant• Location of nuclear power plants• Merits and demerits of nuclear power plants• Selection of site for nuclear power plants• A brief review of nuclear energy• Types of radiations• Nuclear fusion and fission• Nuclear energy• Nuclear fuels• 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	05	9



	<ul style="list-style-type: none">• Power rating of nuclear power plant• 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 in India and Gujarat		
5	Solar Power Generation <ul style="list-style-type: none">• Introduction• Solar energy• Merits and demerits of solar energy• Application of solar energy• Solar radiation and constant• Types of solar radiations• Term related with solar radiation• Measurement of solar radiation• Utilization of solar energy• Types of solar energy collectors• Concentrated solar power generation• Solar thermal power generation• Solar photovoltaic power generation• Block diagram of solar photovoltaic system• Types of solar PV system• Size, output, and cost of solar PV system• Advantage, disadvantage and application of solar PV system• 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• Future of solar energy use in India• Major solar power generation units in India and Gujarat, it's capacity	10	18
6	Wind Power Generation <ul style="list-style-type: none">• Introduction• Wind energy, wind power• Energy flow in wind power generation• Merits and limitations of wind power generation• Instruments for measuring wind• Wind farms• Wind turbine• Types of wind turbine	9	16



	<ul style="list-style-type: none"> • 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 in India and Gujarat, it's capacity 		
7	<p>Power Generation used by other Non-Conventional Energy Sources</p> <ul style="list-style-type: none"> • Introduction • Captive power plant • Diesel electric power plant • Gas based power plant • Magneto hydrodynamic power generation • Thermoelectric power generation • Geothermal power generation • Ocean energy • Biomass energy • Future and development of other non-conventional energy power generation • Other non-conventional energy sources power generation unit in India, it's capacity 	07	13

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%	40%	10%	10%	0%	0%



Suggested List of Tutorial/Exercise:

Sr. No.	Unit No.	Name of Topics	Contact Hours
1	1	To 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, Power Generating capacity of India and Gujarat and Organization of power sector in India and Gujarat.	6
2	2	Draw the single line diagram of steam power plant and explain working of various circuits and function of auxiliary used in SPP	2
3	2	Draw cooling and lubrication system of Turbo-alternation with its working flow.	2
4	2	Prepared technical report on visit steam power plant and prepared report on major steam power plants available in India and Gujarat with location and capacity.	2
5	3	Draw the single line diagram of hydro power plant and state function of various auxiliary used in hydro power plant also classified hydro power plants.	2
6	3	Prepared technical report on visit hydro power plant and prepared report on major hydro power plants available in India and Gujarat with location and capacity.	2
7	4	Draw the single line diagram of nuclear power plant and state function of important auxiliary used in nuclear power plant also prepared a list of nuclear power plants in India with location and capacity	2
8	5	Prepared technical report on visit solar power plant and prepared report on major solar power plants available in India and Gujarat with location and capacity.	2
9	6	Prepared technical report on visit wind power plant and prepared report on major wind power plants available in India and Gujarat with location and capacity.	2
10	7	Draw the single line diagram of diesel power plant and explain working of various system and state the	2



		function of auxiliary used in DPP	
11	7	Prepared technical report on visit biogas/diesel power plant.	2
12	7	Prepared the list of major gas based, biogas and ocean power plants available in India with location and capacity.	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 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/>