

GANPAT UNIVERSITY					
FACULTY OF DIPLOMA ENGINEERING					
Programme	Diploma in Electrical Engineering				
Semester	II		Version	1.0.0.0	
Effective from Academic Year		2025-26	Effective for the batch Admitted in		JULY 2025
Course code	1EE2102	Course Name	Electrical Power Generation		

I. TEACHING-LEARNING AND ASSESSMENT SCHEME																		
Course Type	Course Code	Learning Scheme						Assessment Scheme										
		Actual Contact Hrs./Week			SLH	NLH	Credits	Theory				Practical				Based on SL		Total Marks
		CL	TL	LL				FA-TH	SA-TH	TOTAL		FA-PR	SA-PR	TOTAL		SLA		
								MAX	MAX	MAX	MIN	MAX	MAX	MAX	MIN	MAX	MIN	
DSC	1EE2102	4	-	2	2	8	4	40	60	100	40	30	20	50	20	20	8	170

Abbreviation:	CL- Classroom Learning	TL - Tutorial Learning	LL - Laboratory Learning
	SLH - Self Learning Hours	NLH - Notional Learning Hours	SLA - Self Learning Assessment
	FA - Formative Assessment (Term work +Mid Sem Exam +Attendance)		SA - Summative Assessment

II. PRE-REQUISITES
Fundamental knowledge of Electrical Engineering and Renewable energy sources.

III. INDUSTRY / EMPLOYER EXPECTED OUTCOMES
<p>The electrical power generation industry is experiencing significant shifts due to technological advancements and the push for sustainability. Employers in this sector expect professionals to have a strong understanding of both traditional and renewable energy sources, as well as the ability to adapt to a changing landscape driven by increased demand, smart technologies, and evolving regulations.</p> <p>By focusing on these areas, individuals can develop the skills and knowledge needed to succeed in the evolving electrical power generation industry and contribute to a sustainable energy future.</p>

IV. COURSE LEARNING OUTCOMES
<p>At the end of the course, students will be able to achieve the following course learning outcomes:</p> <p>CO1. Identify and explain the purpose and operation of major components of thermal power plants.</p> <p>CO2. Identify and explain the purpose and operation of major components of nuclear power plants.</p> <p>CO3. Identify and explain the purpose and operation of major components of hydro power plants.</p> <p>CO4. Describe the layout and working principles of different types of captive power plants.</p> <p>CO5. Demonstrate the fundamental principles of solar and wind energy along with their significance as renewable energy sources.</p>

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:				
Name of Unit	Theory Learning outcomes (TLO's) aligned to CO's	Learning Content mapped with Theory Learning outcomes (TLO's) & CO's	Marks	Hours
Unit-1 Thermal Power Plant	<p>TLO 1.1 Energy conversion process in thermal power station</p> <p>TLO 1.2 Schematic diagram of thermal power station</p> <p>TLO 1.3 Main flow circuits: Fuel and Ash circuit, Air and Gas circuit, Feed water and Steam circuit, Cooling water circuit</p>	<p>1.1 Understand the working of thermal power plants and their energy flow.</p> <p>1.2 Explain basic structure and function of thermal power plant layout.</p> <p>1.3 Analyse the working of different circuits in a thermal plant.</p> <p>1.4 Evaluate plant efficiency and suggest performance improvements.</p>	16	16

	<p>TLO 1.4 Efficiency of thermal power station: Thermal efficiency and overall efficiency</p> <p>TLO 1.5 Advantages and disadvantages of thermal power station</p> <p>TLO 1.6 List of thermal power stations in Gujarat with their capacity</p>	<p>1.5 Compare thermal power plants with other types based on advantages/disadvantages.</p> <p>1.6 Identify and recall local/national examples of power plants with data.</p>		
Unit-2 Nuclear Power Plant	<p>TLO 2.1 Energy conversion process for nuclear power station (NPS)</p> <p>TLO 2.2 Nuclear fusion and fission, Chain reaction</p> <p>TLO 2.3 Main elements of nuclear reactor</p> <p>TLO 2.4 Types of nuclear reactor</p> <p>TLO 2.5 Schematic diagram of nuclear power station</p> <p>TLO 2.6 Nuclear waste and its disposals</p> <p>TLO 2.7 Advantages and disadvantages nuclear power station</p> <p>TLO 2.8 List of nuclear power station in Gujarat and India with their Capacity</p>	<p>2.1 Explain how nuclear energy is converted into electrical energy.</p> <p>2.2 Describe the processes of fission, fusion, and chain reaction.</p> <p>2.3 Identify and describe key reactor components like fuel, moderator, etc.</p> <p>2.4 Classify different types of nuclear reactors.</p> <p>2.5 Interpret schematic layout and explain components.</p> <p>2.6 Discuss challenges and solutions for nuclear waste disposal.</p> <p>2.7 Analyse advantages and disadvantages of nuclear energy use.</p> <p>2.8 List major nuclear plants with capacities.</p>	12	12
Unit – 3 Hydro-electric Power Plant	<p>TLO 3.1 Energy conversion process in hydro-electric power station</p> <p>TLO 3.2 Classification of hydro-electric power station</p> <p>TLO 3.3 Constituents of hydro-electric power station: Hydraulic structure, Water Turbines, Electrical equipment</p> <p>TLO 3.4 Different schemes of hydro-electric power station: High head, medium head, low head</p> <p>TLO 3.5 List of major hydro-electric power station in Gujarat with their capacity</p>	<p>3.1 Describe how potential energy of water is converted into electrical energy.</p> <p>3.2 Classify hydro power stations based on capacity, location, and usage.</p> <p>3.3 Identify and describe the main components of a hydro-electric power plant.</p> <p>3.4 Differentiate between various hydro plant schemes based on head and flow.</p> <p>3.5 List major hydro plants in Gujarat and mention their capacity.</p>	12	12
Unit-4 Captive Power Plants	<p>TLO 4.1 Electrical energy conversion of DG sets, advantages, and limitations.</p> <p>TLO 4.2 Energy conversion process in gas-based power plants by single line diagram.</p>	<p>4.1 Understand the working principle of diesel generator sets and evaluate their advantages and limitations.</p> <p>4.2 Explain the layout and types of biomass-based power plants and compare fuel characteristics.</p> <p>4.3 Understand the principle and types of fuel cells and evaluate their</p>	12	12

	<p>TLO 4.3 Electrical Energy conversion process in biomass energy by single line diagram.</p> <p>TLO 4.4 Electrical Energy conversion process in ocean energy technology by single line diagram.</p> <p>TLO 4.5 Electrical Energy conversion process in geothermal energy by single line diagram.</p>	benefits and limitations in clean energy.		
Unit-5 Renewable Energy Power Generation	<p>Solar Power Plant</p> <p>TLO 5.1 Various terms of solar energy for Solar Power plants.</p> <p>TLO 5.2 Solar Concentrated Power System.</p> <p>TLO 5.3 Principle of solar photovoltaic (PV) system.</p> <p>Wind Power Plant</p> <p>TLO 5.4 Basic energy conversion process in wind power plant. Advantages and limitations of wind power plant.</p> <p>TLO 5.5 Concept of Horizontal Axis Wind Turbine (HAWT) and Vertical Axis Wind Turbine (VAWT).</p> <p>TLO 5.6 Concept of Downwind and Upwind wind turbine.</p> <p>TLO 5.7 Wind turbine types (HAWT and VAWT) and their construction</p> <p>TLO 5.8 Concept of Drag and Lift principle of wind turbine.</p> <p>TLO 5.9 List of major wind farms in Gujarat with their capacity</p>	<p>Solar Power Plant</p> <p>5.1 Understand fundamental concepts of renewable energy systems</p> <p>5.2 Identify components and working of solar thermal systems</p> <p>5.3 Understand working and applications of solar PV systems</p> <p>Wind Power Plant</p> <p>5.4 Explain the energy conversion process and evaluate the advantages and limitations of wind power plants.</p> <p>5.5 Differentiate between HAWT and VAWT based on design, operation, and applications.</p> <p>5.6 Describe the working principles and configuration of downwind and upwind wind turbines.</p> <p>5.7 Explain constructional details of HAWT and VAWT wind turbines.</p> <p>5.8 Apply the principles of drag and lift to understand wind turbine blade design.</p> <p>5.9 Identify major wind farm locations in Gujarat along with their capacities.</p>	8	8

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL

Sr. No.	Practical/Laboratory Learning Outcome (LLO)	Practical Titles	Relevant COs
1	LLO 1.1 Schematic diagram of thermal power station	To study thermal power station equipment and its layout.	CO1
2	LLO 2.1 Constituents of hydro-electric power station	To study hydro-electric power station.	CO3
3	LLO 3.1 Schematic diagram of nuclear power station	To interpret the schematic diagram of nuclear power station & explain the function of each component.	CO2
4	LLO 4.1 Layout of Liquid power plant.	To study diesel power station.	CO4

5	LLO 5.1 List of thermal power stations in Gujarat with their capacity.	To prepare a report on thermal power plants.	CO1
6	LLO 6.1 List of major hydro-electric power station in Gujarat with its capacity.	To prepare a report on hydropower plant.	CO3
7	LLO 7.1 List of nuclear power station in Gujarat and India with its Capacity	To prepare a report on nuclear power plants.	CO2
8	LLO 8.1 Solar Photovoltaic (PV) power plant: components layout, construction, working	To prepare a report on solar power plants.	CO5
9	LLO 9.1 Layout of Horizontal axis large wind power plant: Geared wind power plant, Direct-drive wind power plant.	To prepare a report on wind power plants.	CO5
10	LLO 10.1 Different schemes of hydro-electric power station: High head, medium head, low head	To prepare report on NHPC	CO3
11	LLO 11.1 List major nuclear plants with capacities.	To prepare report on NTPC	CO2
12	LLO 12.1 Solar Photovoltaic (PV) power plant: component layout.	To draw circuit of solar panel using PSIM	CO5

VII. SUGGESTED MICRO PROJECT / ASSIGNMENTS / ACTIVITIES FOR SELF LEARNING / SKILL DEVELOPMENT (SELF LEARNING)

- Beyond classroom and laboratory learning, the following co-curricular activities are recommended to enhance the achievement levels of various outcomes in this course
- Students are encouraged to undertake these activities either individually or in groups and prepare comprehensive reports of approximately five pages for each activity.
- Additionally, students should collect/record physical evidence for their portfolios, which could be beneficial during placement interviews: a) Prepare illustrative chart for various power plants.) Prepare working model of equipment used in power plants.
- Collect real time data of electric power generation through Thermal, Hydro, and nuclear power plant in Gujarat state.
- Collect data of electric power generation through Solar, wind, and other renewable energy sources in Gujarat state.
- Prepare technical reports on problems raised due to variable load on power stations.

Mini projects

- Visit nearby Thermal Power station and observe the Layout and write the technical details of Boiler, generator, Turbine, Superheater, Economiser Air Preheater, Cooling Tower etc.
- Visit nearby Hydro Power station and observe the Layout and write the technical details of Generator, working cycles of Turbine, Reservoir, Penstock etc.

VIII. LIST OF INSTRUMENTS / EQUIPMENT / TRAINER BOARD

1	Video Programme/Animation/Demonstration Model of Thermal Power Plant.
2	Video Programme/Animation/Demonstration Model of Hydro Power Plant.
3	Video Programme/Animation/Demonstration Model of Nuclear Power Plant.
4	220 kw solar PV AC system.
5	270 kw solar PV DC system.

IX. LIST OF REFERENCE BOOKS

Sr.No.	Title	Author	Publication
1	A Course in electrical power	J.B. Gupta	S.K. Kataria & Sons
2	Electrical Power Systems	Dr. S.L.Uppal, Prof. S.Rao	Khanna Publisher
3	Generation of Electrical Energy	B. R.Gupta	S. Chand Publishing
4	Principles of Power System	V.K.Mehta, Rohit Mehta	S. Chand Publishing
5	Wind Power Technology	Earnest, Joshua	PHI Learning Pvt. Ltd
6	Renewable Energy Technologies	Chetan singh Solanki	PHI Learning Pvt. Ltd
7	Solar Photovoltaic	Chetan singh Solanki	PHI Learning Pvt. Ltd

X. LINK OF LEARNING WEB RESOURCE

1	https://nptel.ac.in/courses/108102047
2	https://www.electrical4u.com/electrical-engineering-articles/generation/
3	https://lectures.gtu.ac.in/ (related to course content)
4	https://nptel.ac.in/courses/103103206
5	https://mnre.gov.in/
6	https://www.alternative-energy-tutorials.com/
7	https://geda.gujarat.gov.in/

XI. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE

Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	Thermal Power Plant	CO1	16	6	8	2	16
2	Nuclear Power Plant	CO2	12	4	6	2	12
3	Hydro-electric Power Plant	CO3	12	4	6	2	12
4	Captive Power Plants	CO4	12	4	6	2	12
5	Renewable Energy Power Plant	CO5	08	4	2	2	8
Grand Total			60	22	28	10	60

XII. COs AND POs AND PSOs MAPPING

Course outcome (Cos)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	1	0	0	2	0	2	2	2	0
CO2	3	0	0	0	2	0	2	2	1	0
CO3	3	0	1	0	1	0	2	2	2	2
CO4	3	0	0	0	1	0	0	2	1	1
CO5	3	3	1	0	2	0	0	3	2	2

Legends: - 3- High 2-Moderate/Medium 1-Slight/Low 0-None