

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

Course Title: **ELECTRICAL POWER GENERATION**
(Code: 3330904)

Diploma Programme in which this course is offered	Semester in which offered
Electrical Engineering	Third Semester

1. RATIONALE:

The various power plants need highly skilled technicians who are capable of operating various control equipment in normal and abnormal conditions. Efforts are made to develop essential skills like operate, maintain and troubleshoot various equipment in different power plants. Also, the skills to observe safety can be developed in the students by this course while handling electrical system.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competency.

- **Maintain and troubleshoot different equipment used in various power plants.**

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
L	T	P	C	Theory Marks	Practical Marks	Total Marks		
L	T	P	C	ESE	PA	ESE	PA	150
04	02	00	06	70	30	20	30	

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; ESE - End Semester Examination; PA - Progressive Assessment

Note: It is the responsibility of the institute heads that marks for **PA of theory & ESE and PA of practical** for each student are entered online into the GTU Portal at the end of each semester within the dates specified by GTU.

4. COURSE DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I Thermal Power Station	1a.Explain thermal energy conversion process with block diagrams	1.1 Energy conversion process for thermal power station with plant layout
	1b. Identify the appropriate site	1.2 Selection criteria for site of thermal power station
	1c. Describe the working of thermal power station	1.3 Line diagram of thermal power station; Different cycles of thermal power station
	1d. Explain the importance of	1.4 Major equipment and auxiliaries of thermal power station

Unit	Major Learning Outcomes	Topics and Sub-topics
	<p>load curve and load duration curve</p> <p>1e. Differentiate between base load and peak load power plants.</p> <p>1f. Name the major TPS in Gujarat</p>	<p>1.5 Load curve and load duration curve</p> <p>1.6 Terms and factors related to power plant</p> <p>1.7 Base load and peak load stations</p> <p>1.8 Coal based thermal power stations in Gujarat</p>
Unit – II Hydro Power Station	<p>2a. Explain hydro energy conversion process with block diagrams</p> <p>2b. Identify the appropriate site</p> <p>2c. Classify the different types of HPS</p> <p>2d. Name the major HPS in Gujarat</p>	<p>2.1 Energy conversion process for hydro-power station (HPS) with plant layout</p> <p>2.2 Selection of site for HPS</p> <p>2.3 Classification of HPS: based on head, Storage and pondage type, Plant Layout, types of water turbines</p> <p>2.4 Auxiliaries of HPS</p> <p>2.5 Major features of HPS</p> <p>2.6 Hydro power stations in Gujarat</p>
Unit – III Nuclear Power Station	<p>3a. Explain energy conversion process with block diagrams</p> <p>3b. Identify the appropriate site</p> <p>3c. Explain the working of Nuclear power station</p> <p>3d. Describe various types of reactors</p> <p>3e. State special precautions required for NPS</p> <p>3f. Name the major TPS in Gujarat</p>	<p>3.1 Energy conversion process for NPS: Nuclear fusion and fission, Chain reaction</p> <p>3.2 Selection of site for NPS</p> <p>3.3 Special precautions for NPS</p> <p>3.4 Advantages and disadvantage of NPS</p> <p>3.5 Name the nuclear power stations in Gujarat</p>
Unit – IV Solar Power Plant	<p>4a. Explain the various solar energy parameters required for electrical power generation</p> <p>4b. Describe measurement of solar radiations</p> <p>4c. Describe the working of Solar concentrated solar power (CSP) systems</p> <p>4d. Explain principle of solar photovoltaic systems</p> <p>4e. Classify different solar PV system.</p> <p>4f. Explain the issues of grid connection of solar power plants</p> <p>4g. Name the more than 1 MW solar power plants in Gujarat</p>	<p>a. Solar constants, Measurement of solar radiations</p> <p>4.2 Solar Energy Conversion</p> <p>4.3 CSP generators, construction and working principle</p> <p>4.4 construction of a solar PV systems: Solar cell, Module, Panel and array</p> <p>4.5 Types of solar PV system</p> <p>i. Stand –Alone Solar PV system</p> <p>ii. Grid-Interactive solar PV system</p> <p>iii. Hybrid Solar PV system</p> <p>4.6 Grid connection issues of solar power plants</p> <p>4.7 Solar power plants in Gujarat</p>

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – V Wind Power Plant	5a. Describe the function of anemometer and wind vane 5b. Describe the significance of the wind speed and the power derived from the wind. 5c. With the sketches describe the different types of wind turbines. 5d. Explain the drag and lift principle of rotation of the wind turbine rotor. 5e. With sketches describe the construction of a typical geared, direct drive and hybrid large WPPs. 5f. Describe the principles of different types of aerodynamic controls of WPPs. 5g. With single line diagram explain the reasons for using the five different types of electrical generators used in large wind power plants 5h. Describe the various components of the direct drive and geared small wind turbine 5i. Name the major wind farms in Gujarat	5.1 Anemometer and wind vane 5.2 Site selection, wind speed, wind direction and its relationship with wind power 5.3 Wind turbine types and their construction 5.4 Drag and lift principle of rotation of the wind turbine rotor. 5.5 Geared WPPs, direct drive WPPs and Hybrid WPPs 5.6 Stall control, pitch control and active stall control of WPPs. 5.7 Squirrel cage Induction Generators(IG), wound rotor IG, doubly fed IG, 5.8 Wound rotor synchronous generator 5.9 Permanent magnet synchronous generator 5.10 Direct-drive and geared small wind turbines 5.10 Major wind farms in Gujarat.
Unit – VI Captive power plant and other renewable energy sources	6a. Explain the concept for captive power plants 6b. Classify Gas based power generation systems 6c. With line diagrams describe the principle of biomass electrical energy conversion systems. 6d. With line diagrams describe the principle of ocean energy electrical conversion systems 6e. With line diagrams describe the principle of geothermal electrical energy conversion systems	6.1 Single line diagram, energy conversion process, advantages, disadvantages and limitations of DG sets 6.2 Single line diagram, energy conversion process, advantages, disadvantages and limitations of Gas based power plants 6.3 Biomass electrical energy conversion process. 6.3 Ocean energy electrical conversion systems 6.4 Geothermal electrical energy conversion systems

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Thermal Power Station	12	06	04	02	14
II	Hydro Power Station	06	05	03	02	10
III	Nuclear Power Station	08	05	03	02	14
IV	Solar Power Plant	08	02	03	05	08
V	Wind Power Plant	08	02	02	06	10
VI	Captive power plant and other renewable energy sources	08	05	02	03	14
Total		56	27	26	17	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as only general guideline for students and teachers. The actual distribution of marks in the question paper may vary from above table.

6. SUGGESTED LIST OF EXERCISES/PRACTICAL

The tutorials should be properly designed and implemented with an attempt to develop different types of skill leading to the achievement of above mentioned competency

S. No.	Unit No.	Practical/Exercise	Apprx. Hrs. Required
1	I	Interpret the line diagram of Thermal Power Station (T.P.S.) and main cycles & explain working of T. P. S.	02
2	I	Prepare technical report of visit to a nearby T.P.S.	04
3	I	Collect the data from nearest power station for load curve preparation and interpret it.	02
4	II	Prepare technical report of visit to a nearby H.P.S.	04
5	III	Interpret the schematic diagram of Nuclear power station & explain the function of each component.	02
6	IV	Prepare technical report of visit to a nearby Solar PV station.	04
7	V	Prepare technical report of visit to a nearby Wind farm.	04
8	V	Assemble/dismantle direct drive small wind turbine	02
9	V	Assemble/dismantle geared small wind turbine	02
10	VI	Interpret and interpret schematic diagram of Diesel Power Station	02
11	VI	Prepare technical report of visit to a nearby Diesel Power Station.	04
12	VI	Interpret and interpret schematic diagram of gas based power	02

S. No.	Unit No.	Practical/Exercise	Apprx. Hrs. Required
		plant	
13	-	Collect data of generating capacity of conventional & non conventional power plants in India. (Total generation of India and Gujarat)	02
Total			32

7. SUGGESTED LIST OF STUDENT ACTIVITIES

- i. Assignment on solving tutorial
- ii. Visit to nearby Thermal power station
- iii. Visit to nearby Hydro power station
- iv. Visit to nearby Solar PV station
- v. Visit to nearby Wind farm.
- vi. Visit to nearby diesel power plant.
- vii. Collect data of generation for India and Gujarat

8. SUGGESTED LEARNING RESOURCES

(A) List of Books:

S. No.	Title of Books	Author	Publication
1	Electrical Power system	Mehta, V.K.	S. Chand and company, New Delhi, 2011
2	Electrical Power	Uppal, S.L.	Khanna publication, New Delhi, 2011
3	Wind Power Plants and Project Development	Earnest, Joshua and Wizelius, Tore	PHI Learning, New Delhi, 2011
4	Renewable Energy Technologies – A Practical Guide for Beginners	Solanki, Chetan Singh	PHI Learning, New Delhi, 2011
5	Power plant Engineering	Nag, P K	Tata McGraw Hill, New Delhi, 2011
6	Non conventional energy sources	Rai, G.D.	Khanna publication, New Delhi, 2011
7	Generation and Utilization of Electrical Energy	S. Sivanagaraju	Pearson, New Delhi, 2011.

B. List of Major Equipment/Materials with broad specifications

- i. 5 kW Solar PV system
- ii. 2 kW concentrated solar power (CSP) system
- iii. 2 kW DG system
- iv. 1 kW direct drive small wind turbines
- v. 5 kW geared small wind turbine
- vi. Illustrative charts for TPS
- vii. Illustrative charts for HPS

- viii. Illustrative charts for NPS
- ix. Illustrative charts for gas based plants

C List of Software/Learning Websites

- i. www.energysouldbe.org/
- ii. www.power-genindia.com/
- iii. www.indiastat.com

9. INSTRUCTIONAL STRATEGIES

- i. Power point presentation
- ii. Overhead projector
- iii. Visit to nearby power station
- iv. Visit to wind farms
- v. Solving the tutorials
- vi. Display of video films on working of different type of power stations.

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- Smt. A. A. Amin, Sr. Lecturer, Electrical Engineering Department, Govt. Polytechnic, Vadnagar.
- Shri B. R. Shrotriya, Sr. Lecturer, Electrical Engineering Department, Govt. Polytechnic, Ahmedabad.
- Shri N.N.Pandya, Sr. Lecturer, Electrical Engineering Department, Govt. Polytechnic, Ahmedabad.
- Shri V. C. Jagani, Sr. Lecturer, Electrical Engineering Department, Govt. Polytechnic, Junagadh.
- Shri. J.K.Rathod, HOD, Electrical Engineering Department, TFG Polytechnic, Adipur, Gujarat
- Shri K. V. Dave, Sr. Lecturer, Electrical Engineering Department, Govt. Polytechnic, Rajkot

Coordinator and Faculty Members from NITTTR Bhopal