

Subject Code: 1ET4020605	Subject Title: Power Plant Engineering
Pre-Requisite	--

RATIONALE

Availability of power is the one key area where most of the Indian industry is facing problems. In India, even today, short fall of power generation is about 30 percent. Fuel supply and distribution is also an area where country is still developing smooth lines of supply. Since power and energy is required by every sector of economy, the growth in this sector is must if Indian economy grows in any sector. Many of the job opportunity in private as well as public sector are therefore waiting for students in this field. Hence, this course attempts to provide them basic knowledge of the technologies available at plant level and would also acquaint them with the latest technological advances taking place in this sector.

COMPETENCY

The course content should be taught and implemented with the aim to develop required skills in the students so that they are able to acquire following competency.

Apply knowledge of mechanical engineering related to power generation systems, their control and economics in different type of power plants for their operation and maintenance.

COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- Identify elements and their functions of steam, hydro, diesel, nuclear, wind and solar power plants.
- Operate equipments of different power plants.
- Analyze economics of power plants and list factors affecting the power plants
- Determine performance of power plants based on load variations.

TEACHING AND EVALUATION SCHEME:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)			
Lecture	Tutorial	Practical	Credit	Theory		Practical	
				University Assessment	Continuous Assessment	University Assessment	Continuous assessment
3	-	2	4	60	40	20	30

COURSE DETAILS.

Sr. No.	Topic	Total Hours	Weightage (%)
1	Introduction to Power plants. 1.1. Energy needs of India. 1.2. Introduction to power plants & their importance, power plants concepts, types and energy conversion in each type. 1.3. National Grids. 1.4. Hydro power plant: General arrangement & its operation, classification, advantages and disadvantages, technical data of hydro power plants in Gujarat. 1.5. Diesel power plant: General arrangement & its operation, classification, advantages and disadvantages, technical data of diesel engine power plants in Gujarat. 1.6. Nuclear power plant: general arrangement & its operation, classification, basic nuclear physics fundamentals, criteria for selection of installation of nuclear power plant, advantages and disadvantages, technical data of nuclear power plants in Gujarat, safe disposal of nuclear waste.	08	20
2	Steam power Plants. A. Heat Cycles 2.1 Working of Rankine cycle, reheats cycle regenerative cycle, reheat regenerative cycles and plot them on P-v and T-s diagram. 2.2 Simple numerical based on above. B. High Pressure Boilers. 2.3 Working sketch and working of high pressure boilers: Lamont boiler, Benson boiler, Loeffler boiler, Velox boiler, Schmidt Hartman boiler, Ramsin boiler 2.4 Stirling boiler (three steam drum, two mud drum boiler)-sketch and working. 2.5 Fluidized bed combustion boilers(FBC): principle, need, types, different arrangement, control system and advantages over other boiler systems. 2.6 Need of water treatment plant for boilers. C. Important Auxiliaries of Steam Power Plants. 2.7 Schematic diagram of modern thermal power plant. 2.8 Super heaters and air pre heaters. 2.9 Fuel handling systems-methods of coal handling like pulverized fuel system, etc. 2.10 Concept of Electro-Static Precipitators (ESP). D. Steam Power Plant Controls 2.11 Effect of load variation in steam power plant. 2.12 Area and centralized control system of power plants. 2.13 Basic elements and requirements of good	20	40

	controlsystem of power plant. 2.14 Instrumentations used in modern power plants. 2.15 Concept of Steam temperature control and feed water control systems. 2.16 Need of record keeping.		
3	Gas Turbine Power Plant. 3.1 Introduction to gas turbine power plant. 3.2 Concept of Brayton cycle. 3.3 Arrangement of open and close cycle with constant pressure gas turbine power plant. 3.4 Components of gas turbine power plant. 3.5 Essential auxiliaries of gas turbine power plant. 3.6 Methods to improve the thermal efficiency of a simple open cycle constant pressure gas turbine power plant (No derivation). 3.7 Simple numerical based on above. 3.8 Advantages of gas turbine power plant over others.	05	15
4	Solar and Wind Power Plants. 4.1 Wind power plant: introduction, advantages and disadvantages. 4.2 Introduction to solar power plant. 4.3 Solar cell and solar panel. 4.4 Conversion systems for solar energy: i. Low temperature system with flat plate collector. ii. Medium temperature system with concentrator collector. iii. Tower concept for power generation. iv. Satellite solar power. v. Zero energy house concept. 4.5 Potential of solar and wind energy in India.	04	15
5	Economic Analysis of Power Plants. 5.1 Cost of electrical energy. 5.2 Selection of type of generation. 5.3 Performance and load deviation of power plants. 5.4 Simple numerical based on above.	05	10

SUGGESTED LIST OF EXERCISES/PRACTICALS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (outcomes in psychomotor and affective domain) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

Sr. No.	Practical Exercises	Approx Hrs. required
1	Preparatory activity: a. Prepare list of various major power plants installed in Gujarat along with their total capacity. b. Visit websites of NTPC, BHEL etc and find out the technical	02

	information about their machineries or Plants.	
2	Study of high pressure boilers (any three): Students would: a. Demonstrate working of boilers and different components on them. (Actual or Video). b. Draw schematic diagram with labels for each. c. Write specification of each boiler. d. List functions and explain working of different components of each boiler.	02
3	Presentation (In a group of 4 - 6 students): Faculty will assign any one topic from following. i. Steam based power plant. ii. Gas turbine power plant. iii. Solar power plant. iv. Wind power plant. v. Nuclear power plant. Students would: a. Download technical specifications/ catalogues, videos or any other suitable presentations on given topic. b. Tabulate comparison of different power plants of same category, based on their different technical aspects. c. Prepare the presentation and present the same during the laboratory hours in front of your classmates.	06
4	Model preparation and exhibition (In a group of 08 - 12 students): Faculty will assign any one topic from following. i. Steam based power plant along with auxiliaries. ii. Gas turbine power plant. iii. Solar power plant. iv. Wind power plant. v. Nuclear power plant. vi. Any other relevant assigned by batch teacher. Students would prepare a model on the topic assigned by batch teacher using preferably waste material. a. Prepare work distribution matrix. b. Prepare the schematic diagram. c. Prepare model diagram with dimensions. d. List steps to be followed to prepare the model. e. Prepare the model and list the difficulties and remedial measures undertaken. f. Prepare charts/ PPTs/ videos or other supporting materials for open air seminar presentation if required. g. Arrange exhibition of the model prepared in the department. Above developed model should be demonstrated in the institute with open air seminar and present the same amongst the students and faculty. Students should explain their findings and learning to other students. Record the movie of exhibition.	12
5	Industrial visit: Faculty would Arrange industrial visit on any one of following	06

	(Compulsory): i. Thermal power plant. ii. Gas turbine power plant. iii. Nuclear power plant. iv. Wind turbine power plant. Student would prepare report on visit. Report should include specification of plant, circuit diagram, working principle of major components, etc.	
Total Hours		28

SUGGESTED LEARNING RESOURCES

A. List of Books:

S. No.	Title of Book	Author	Publication
1.	Power Plant Engineering.	Dr. P C Sharma	S. K. Kataria
2.	Power Plant Engineering.	Domkundwar	
3.	Power Plant Engineering.	P K Nag	Tata McGraw Hill
4.	Power Plant Engineering.	Black & Veatch	Springer, 1996
5.	Power Plant Engineering.	C. Elanchezhian, L. Saravanakumar, B. VijayaRamnath	I.K. International Publishing House
6.	Power Station Engineering and Economy.	Bernhardt G A Sarotzki, William A Vopat	Tata McGraw Hill
7.	A Text Book of Power Plant Engineering.	R K Rajput	Laxmi Publications,
8.	Power Plant Control and Instrumentation.	David Lindsley	The Institute Of Electrical Engineers
9.	Nuclear Power Plant Engineering.	James H. Rust	Haralson Publishing Company
10.	Steam power plant engineering.	Louis Allen Harding	J. Wiley & Sons, inc

B) List of Major Equipment/ Instrument with Broad Specifications:

Sr. No.	Resource with brief specification.
1	Demonstration models of steam power plant and its auxiliaries, Gas turbine power plant and its auxiliaries, wind turbine power plant and its auxiliaries, nuclear power plant and its auxiliaries, solar power plant and its auxiliaries, etc.

C. List of Software/Learning Websites.

- i. <http://nptel.ac.in/courses/112105051/>
- ii. https://www.youtube.com/watch?v=Ota2_LUuar0
- iii. https://www.youtube.com/watch?v=Ota2_LUuar0
- iv. <https://www.youtube.com/watch?v=3dJAtHaSQ98>
- v. <https://www.youtube.com/watch?v=xokHLFE96h8>
- vi. <http://www.tatapower.com/businesses/renewable-energy.aspx>
- vii. <http://www.cleanlineenergy.com/technology/wind-and-solar>
- viii. <https://www.youtube.com/watch?v=kbuLfXgw4Gs>
- ix. <https://www.youtube.com/watch?v=r9q80sSHxKM>

x. https://www.youtube.com/watch?v=GZKKWz_tX1c

xi. download other power plant related videos from youtube.com for study purpose.