


Buddha Institute of Technology, GIDA, Gorakhpur			
Department: Mechanical Engineering Department			
Academic Semester: July- Dec 2022			
Semester: VII	Section: A	Course Code: KME 076	Course: Power Plant Engineering
Course Instructor: Mr. Ankit Tripathi		Contact Hours /week:	# of credits:
CIE Marks: 30		SEE Marks:100	Exam Hours: 03

Prerequisites if any: 1. Basics of Thermodynamics 2. Use of Steam Table			
Code No	Course Name	Description	Semester
1.	Basics of Thermodynamics	Laws of thermodynamics	3 rd
2.	Basics of Thermodynamics	Use of Steam Table	3 rd

Content delivery:	Chalk & Board, System/Laptop with videos, power point
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COURSE SYLLABUS:			
Module No.	Contents of Module	Hrs	COs
1	Introduction: Power and energy, sources of energy, review of thermodynamic cycles related to power plants, fuels and combustion calculations. Load estimation, load curves, various terms and factors involved in power plant calculations. Effect of variable load on power plant operation, Selection of power plant units. Power plant economics and selection Effect of plant type on costs, rates, fixed elements, energy elements, customer elements and investor's profit; depreciation and replacement, theory of rates. Economics of plant selection, other considerations in plant selection.		CO1

2	<p>Steam power plant: General layout of steam power plant, Power plant boilers including critical and super critical boilers. Fluidized bed boilers, boilers mountings and accessories, Different systems such as coal handling system, pulverisers and coal burners, combustion system, draft, ash handling system, Dust collection system, Feed water treatment and condenser and cooling towers and cooling ponds, Turbine auxiliary systems such as governing, feed heating, reheating, flange heating and gland leakage. Operation and maintenance of steam power plant, heat balance and efficiency, Site selection of a steam power plant.</p>		C02
3	<p>Diesel power plant: General layout, Components of Diesel power plant, Performance of diesel power plant, fuel system, lubrication system, air intake and admission system, supercharging system, exhaust system, diesel plant operation and efficiency, heat balance, Site selection of diesel power plant, Comparative study of diesel power plant with steam power plant.</p> <p>Gas turbine power plant: Layout of gas turbine power plant, Elements of gas turbine power plants, Gas turbine fuels, cogeneration, auxiliary systems such as fuel, controls and lubrication, operation and maintenance, Combined cycle power plants, Site selection of gas turbine power plant, Integrated Gasifier based Combined Cycle (IGCC) systems.</p>		C03
4	<p>Nuclear power plant: Layout and subsystems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, safety measures for nuclear power plants.</p> <p>Hydroelectric and Non-Conventional Power Plant: Hydroelectric power plants, classification, typical layout and components, principles of wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell power systems.</p>		C04
5	<p>Electrical system: Generators and generator cooling, transformers and their cooling, bus bar, etc.</p> <p>Energy Saving and Control: Energy, economic and environmental issues, power tariffs, load distribution parameters, load curve, capital and operating cost of different power plants, pollution control technologies including waste disposal options for coal and nuclear plants.</p>		C05

LESSON PLAN

Lecture #	Module #	Topics	RBT Levels	Course Outcome Mapping	Planned Date	Actual Date	Faculty Sign	Remarks
1	1	Power and energy, sources of energy	L2	CO1	16/8/22	16/8/22		
2		Solid fuels, Classification of coal liquid fuel and gaseous fuel.			17/8/22	17/8/22		
3		Review of thermodynamic cycles related to power plants Rankine cycle.			18/8/22	18/8/22		
4		Review of thermodynamic cycles related to power plants Rankine cycle.			18/8/22	20/8/22		
5		Various terms and factors involved in power plant calculation-Load estimation			20/8/22	22/8/2022		
6		Load curves. Otto cycle, Diesel cycle, Brayton cycle			22/8/22	23/8/22		
7		Tutorial-1			22/8/22	24/8/22		
8		Load curves. Otto cycle, Diesel cycle, Brayton cycle			22/8/22	25/8/22		
9		Load curves. Otto cycle, Diesel cycle, Brayton cycle			23/8/22	26/8/22		
10		Load curves. Otto cycle, Diesel cycle, Brayton cycle			24/8/22	30/8/22		

11	Load curves. Otto cycle, Diesel cycle, Brayton cycle			25/8/22	31/8/22		
12	Load curves. Otto cycle, Diesel cycle, Brayton cycle			26/8/22	1/9/22		
13	Load curves. Otto cycle, Diesel cycle, Brayton cycle			27/8/22	2/9/22		
14	Fuels and combustion calculations			29/8/22	3/9/22		
15	Fuels and combustion calculations			29/8/22	5/9/22		
16	Problems on thermodynamic cycle			30/8/22	5/9/22		
17	Problems on thermodynamic cycle			30/8/22	6/9/22		
18	Problems on thermodynamic cycle			30/8/22	6./9/22		
19	Tutorial-2			31/8/22	7/9/22		
20	Selection of power plant units Power plant economics and selection, Effect of plant type on costs			31/8/22	8/9/22		
21	Selection of power plant units Power plant economics and selection, Effect of plant type on costs			1/9/22	9/9/22		
22	Rates, fixed elements, energy elements			2/9/22	10/9/22		
23	Customer elements and investor's profit			3/9/22	12/9/22		
24	Depreciation and replacement, Theory of rates			5/9/22	13/9/22		
25	Depreciation and replacement, Theory of rates			5/9/22	14/9/22		

26		Economics of plant selection, other considerations in plant selection			6/9/22	15/9/22		
27		Economics of plant selection, other considerations in plant selection			6/9/22	16/9/22		
28		General layout of steam power plant, Power plant boilers including critical and super critical boilers			7/9/22	21/9/22		
29		Tutorial-3			7/9/22	22/9/22		
30		General layout of steam power plant, Power plant boilers including critical and super critical boilers			8/9/22	23/9/22		
31		Fluidized bed boilers, Boilers mountings and accessories			9/09/22	24/9/22		
32		Fluidized bed boilers, Boilers mountings and accessories			10/9/22	26/9/22		
33		Fluidized bed boilers, Boilers mountings and accessories	L2,L3	CO2	12/9/22	27/9/22		
34		Fluidized bed boilers, Boilers mountings and accessories			13/9/22	28/9/22		
35		Fluidized bed boilers, Boilers mountings and accessories			14/9/22	1/10/22		
36	2	Different systems such as coal handling system			15/9/22	3/10/2022		
37		Different systems such as coal handling system			15/9/22	7/10/22		
38		Pulverizes and coal burners, Combustion system, and draft, ash handling system. Dust collection system			16/9/22	8/10/22		
39		Tutorial-4			17/9/22	10/10/22		

40		Feed water treatment and condenser and cooling towers and cooling ponds.			22/9/22	11/10/22		
41		Problems on Rankine Cycle			23/9/22	12/10/22		
42		Problems on Rankine Cycle			24/9/22	14/10/22		
43		Problems on Rankine Cycle			26/9/22	15/10/22		
45		Problems on Rankine Cycle			27/9/22	18/10/22		
46		Operation and maintenance, Heat balance and efficiency of steam power Plant (INCLUDING SITE SELECTION)			28/9/22	19/10/22		
47		Tutorial-5			29/9/22	20/10/22		
48		Layout and Elements of			30/9/22	21/10/22		
49		gas turbine power plants, Gas turbine fuels and cogeneration.			1/10/22	22/10/22		
50		Problems on gas turbine			3/10/22	27/10/22		
51		Problems on gas turbine			6/10/22	28/10/22		
52		Problems on gas turbine			7/10/22	29/10/22		
53		Problems on gas turbine			8/10/22	29/10/22		
54		Problems on gas turbine			10/10/22	31/10/22		
51		Tutorial-6			11/10/22	3/11/2022		
52		Combined cycle power plants.			12/10/22	4/11/22		
53		Site selection of gas turbine power plant			13/10/22	5/11/22		
54	3	Integrated Gasifier based Combined Cycle (IGCC) systems.	L3	CO3,	14/10/22	7/11/22		

55	General layout, Components of Diesel power plant.			15/10/22	8/11/22		
56	Performance of diesel power plant, Fuel system, lubrication system.			17/10/22	8/11/22		
57	Air intake and admission system supercharging system			18/10/22	14/11/22		
58	Tutorial-7			19/10/22	14/11/22		
59	Comparative study of diesel power plant with steam power plant			20/10/22	14/11/22		
60	Nuclear power plant Principles of nuclear energy.			21/10/22	15/11/22		
61	Lay out of nuclear power plant Basic components of nuclear reactions			22/10/22	15/11/22		
62	Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR)			31/10/22	15/11/22		
63	Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), Gas Cooled and Liquid Metal Cooled Reactors			29/10/22	16/11/22		
64	Safety measures and Site selection of nuclear power plants, nuclear power station.			1/11/22	16/11/22		
65	Tutorial-8			2/11/22	16/11/22		
66	Hydroelectric power plants, classification, typical layout and components,	4	L2	C04	3/11/22	17/11/22	
67	Hydroelectric power plants, classification, typical layout and components,				4/11/22	17/11/22	

68		Hydroelectric power plants, classification, typical layout and components,			7/11/22	17/11/22		
69		Hydroelectric power plants, classification, typical layout and components,			8/11/22	18/11/22		
70		Hydroelectric power plants, classification, typical layout and components,			9/11/22	18/11/22		
71		Principles of wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell power			10/11/22	18/11/22		
72		Principles of wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell power			14/11/22	19/11/22		
73		Transformers and their cooling, bus bar, etc			15/11/22	19/11/22		
74		Tutorial-9			16/11/22	19/11/22		
75		Energy, economic and environmental issues			17/11/22	19/11/22		
76		Power tariffs, load distribution parameters, load curve, capital and operating cost of different power plants			18/11/22	19/11/22		
77	5	Pollution control technologies including waste disposal options for coal and nuclear plants.	L2	C05	19/11/22	21/11/22		
78		Pollution control technologies including waste disposal options for coal and nuclear plants.			21/11/22	23/11/22		

79	Pollution control technologies including waste disposal options for coal and nuclear plants.			22/11/22	24/11/22		
80	Pollution control technologies including waste disposal options for coal and nuclear plants.			23/11/22	26/11/22		
81	Tutorial-10			24/11/22	28/11/22		
82	REVISION			25/11/22			
83	REVISION			26/11/22			
84	REVISION			27/11/22			
	REVISION			28/11/22			

Literature:

- 1) Power Plant Engineering by – P. K. Nag
- 2) Steam and Gas Turbine Power Plant- R. Yadav
- 3) A Textbook of Power Plant Engineering by R. K. Rajput
- 4) <https://www.power-technology.com/features/featureigcc-the-future-of-coal-power-4583854/>
- 5) <https://www.power-technology.com/features/feature-the-top-10-biggest-thermal-power-plants-in-india/>
- 6) <http://www.thermodyneboilers.com/what-is-boiler/>

Sample Questions:

Question No.	Questions
1	Enumerate major source of energy

2	The Peak load on a Power Plant is 60 MW. The loads having maximum demands of 30MW, 20MW, 10MW and 14MW are connected to the power plant. The capacity of the Power Plant is 80MW and the annual load factor is 0.50. Estimate a) The average load on the power plant b) The energy supplied per year c) The demand factor d) The diversity factor
3	List out the various thermal power plants in India
4	Draw General layout of steam power plant and explain it briefly
5	Fluidized bed boilers
6	How is dust collectors classified? Explain with the help of a diagram the working of a Cyclone separator
7	What is gasification? Explain Integrated Gasifier based Combined Cycle (IGCC) systems.
8	What do you understand by cogeneration of power and process heat? Explain its thermodynamic advantage
9	Explain Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR).
10	Explain , biogas and fuel cell power systems.
11	What are the important Pollution control technologies including waste disposal options for coal and nuclear plants?
12	In a gas turbine cycle, the turbine output is 600kJ/kg, the compressor work is 400kJ/kg, and the heat supplied is 1000 kJ/kg. The thermal efficiency of the cycle is-?
13	What is cooling Tower? How are cooling tower classified? Explain any one of them with a neat sketch
14	Boilers mountings and accessories

Assessment rubrics that is going to be adopted for direct attainment is depicted in below table

Level of Achievement	Elaboration on Course Grading Description	Bench Mark Set (Out of 25)
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Excellent (A)	The Student's performance is outstanding in almost all the intended course learning outcomes	21 to 25
Good (B)	The student's performance is good in most of the intended course learning outcomes.	15 to 20
Marginal (C)	The student's performance is barely satisfactory. It marginally meets the intended course learning outcomes	12 to 14
Fail (F)	The Students performance is inadequate. Student fails to meet many of the intended course learning outcomes	Less than 12