IV B.Tech II Semester		L	T	P	C
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18MEC421	POWER PLANT ENGINEERING				

Course Educational Objectives:

1. To understand the working principles of steam power plants and analyzes its performance.
2. To understand the working principles of diesel and gas turbine power plant
3. To explain the working of nuclear power plant and safety measures.
4. To know the working of hydroelectric power plant and other renewable energy sources
5. To learn the economics, Energy management and environmental issues of power generation.

UNIT – 1: STEAM POWER PLANT (9)

Introduction to the sources of energy – Resources and development of power in India. Steam Power Plant: Plant layout – Working of different circuits – Types of coal – Properties of coal – Coal handling system – Ash handling system – Feed water treatment. **Combustion Process**: Stages of combustion – Overfeed and underfeed stoker firing – Stoker firing of coal – Pulverized coal firing system – Cyclone furnace – Fluidized bed combustion system – Cooling towers and heat rejection.

UNIT – 2: DIESEL AND GAS TURBINE POWER PLANT (9)

Diesel Power Plant: Introduction – IC Engines, types, construction – Plant layout with auxiliaries – Fuel supply system, air starting equipment, lubrication and cooling system – Super charging. **Gas Turbine Power Plant**: Introduction – Classification – Construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines – Combined cycle power plants and comparison.

UNIT – 3: NUCLEAR POWER PLANT (9)

Basics of nuclear engineering– Fuels and nuclear reactions – Layout and subsystems – Reflectors – Pressurized water reactor (PWR) – Boiling water reactor (BWR) – CANada Deuterium- Uranium reactor (CANDU) – Gas cooled and liquid metal fast breeder reactor – Heavy water reactor – Working and comparison – Safety measures for nuclear power plants.

UNIT – 4: HYDROELECTRIC POWER PLANT AND RENEWABLE ENERGY SOURCES (9)

Hydroelectric Power Plant: Water power – Hydrological cycle – Hydrographs – Storage and pondage – Classification of dams and spill ways – Hydroelectric typical plant layout and components – Pumped storage power plants – Selection of turbines. **Renewable Energy Sources: C**onstruction and working principle of wind, tidal, solar photo voltaic, solar thermal, geo thermal, biogas and fuel cell systems.

UNIT – 5: ENERGY MANAGEMENT, ECONOMICS AND ENVIRONMENTAL ISSUES (9)

Energy Management: Types of loads – Load distribution and sharing – Load curve – Demand factor – Average load – Load factor – Diversity factor – Cost of electrical energy – General arrangement of power distribution – Economics in power plant selection and power generation. **Environmental Issues:** Effluents from power plants – Impact on environment – Pollutants – Pollution standards – Methods of Pollution control – Control of waste disposal and recovery – Waste disposal options for coal and nuclear power plants.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Know the working principles of steam power plants and analyzes its performance.	**PO1,PO2,PO3, PO6, PO7, PO12**
CO2	Explain the working of diesel and gas turbine power plant	**PO1,PO3, PO6, PO7, PO12**
CO3	Understand the working principles of nuclear power plant and safety measures	**PO1,PO2,PO3, PO6, PO7, PO12**
CO4	Explain the working of hydroelectric power plant and other renewable energy sources	**PO1,PO2,PO3, PO6, PO7, PO12**
CO5	Describe the economics, Energy management environmental issues of power generation	**PO1,PO2,PO3, PO6, PO7, PO12**

Text books:

1. Power Plant Engineering, P.K.Nag, 4/e, 2014, McGraw-Hill Education Pvt. Ltd., New Delhi.
2. Power Plant Engineering, R.K Hegde, 1/e, 2015, Pearson Education, India.

Reference books:

1. Power Plant Technology, M. M. El-Wakil, 1/e, 2010, Tata McGraw-Hill, New Delhi.
2. A Course in Power Plant Engineering, Arora and S. Domkundwar, 6/e, 2012, Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
3. Introduction to Power Plant Technology, G.D.Rai, 3/e, 2012, Khanna Publishers, New Delhi.
4. Power Plant Engineering, G.R. Nagpal and S.C. Sharma, 16/e, 2004, Khanna Publisher, New Delhi.
5. A Text Book of Power Plant Engineering, R.K.Rajput, 5/e, 2016, Laxmi Publications (P) Ltd., New Delhi.
6. Power Generation Handbook, Philip Kiameh, 2/e, 2013, Tata McGraw-Hill, New Delhi.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	-	-	1	1	-	-	-	-	1
CO.2	3	-	2	-	-	1	1	-	-	-	-	1
CO.3	3	2	1	-	-	1	1	-	-	-	-	1
CO.4	3	2	1	-	-	1	1	-	-	-	-	1
CO.5	3	2	1	-	-	1	3	-	-	-	-	2
CO*	**3**	**2**	**1.4**	-	-	**1**	**1.4**	-	-	-	-	**1.5**

QUESTION BANK

Question No.	Questions	B T	PO Attainment
	UNIT 1 – STEAM POWER PLANT		
	PART-A (Two Marks Questions)		
1	List the four important circuits of the steam power plant.	U	PO1
2	What principle, steam power plant works?	R	PO1
3	What are the different methods of coal firing systems?	R	PO1
4	Discuss the advantages of mechanical methods of firing coal.	C	PO1
5	Explain the working of Chain grate stoker with simple sketch.	U	PO1
6	Explain the working of Spreader stoker	U	PO1
7	Explain the working of Multi retort stoker with simple sketch.	U	PO1
8	Name the various methods of ash handling systems.	R	PO1
9	Why it is essential to quench the ash before handling?	R	PO1
10	Name the different types of coal-pulverising mills.	R	PO1
11	Name various draught systems.	R	PO1
12	State the advantages of steel chimney.	An	PO1
13	State the advantages of pulverised fuel firing	An	PO1
14	What is the cause of smoke?	R	PO1
15	Define the overall efficiency of a steam power plant.	R	PO1
16	What is meant by compounding of steam turbines?	R	PO1
17	What is meant by pulverized and why it is used?	R	PO1
18	Mention the various modern ash handling systems.	R	PO1
19	What is stoker? Classify it.	R	PO1
20	What is meant by ‘over feed’ and ‘under feed’ principles of firing coal?	R	PO1
	PART-B (Ten Marks Questions)		
1	Draw a general layout of steam power plant with neat diagram and explain the working of different circuits.	U	PO3
2	Explain in detail the coal handling system with a suitable block diagram.	U	PO3
3	What are the different methods of firing coal? Discuss the advantages of mechanical methods of firing coal.	R	PO3
4	Make neat sketch and explain the working of: (i) Chain grate stoker (ii) Spreader stoker. (iii) Multi retort stoker.	C	PO3
5	Describe the various types of grates used with hand fired furnaces.	E	PO3
6	Describe the various methods used to fire pulverised coal.	E	PO3
7	Make a neat sketch of ball and Race mill and explain its working.	C	PO3
8	Name the different types of coal-pulverising mills. Describe Ball-Mill.	R	PO3
9	Describe the various types of burners used to burn pulverised coal.	E	PO3
10	State the advantages and disadvantages of a steam power station as compared to hydroelectric power station and nuclear power station.	An	PO3

	UNIT 2 – DIESEL AND GAS TURBINE POWER PLANT		
	PART-A (Two Marks Questions)		
1	What are the essential component of diesel power plants?	R	PO1
2	List the various Liquid Cooling Systems?	R	PO1
3	What is the purpose of super charging?	R	PO1
4	Define Flywheel?	U	PO1
5	Write the Disadvantages of over cooling of the Engine?	R	PO1
6	Write the function of Lubrication?	R	PO1
7	What are the classifications of Lubrication system?	R	PO1
8	Write a note on heat balance sheet.	R	PO1
9	What are the advantages of supercharger?	R	PO1
10	State the applications of a diesel power plant?	R	PO1
11	Write a short notes on super charging.	R	PO1
12	How does detonation affect engine performance in CI engines?	R	PO1
13	Define – closed cycle gas turbine?	R	PO1
14	What are the methods to improving the thermal efficiency in open cycle gas	R	PO1
15	Define turbo charging in combined gas turbine and diesel cycles?	R	PO1
16	Define – open cycle gas turbine?	R	PO1
17	Give the advantages and limitations of gas turbine power plant.	R	PO1
18	Give the applications of gas turbine power plant.	R	PO1
19	Name the major components of a gas turbine plant.	R	PO1
20	Define Air-rate and work-ratio.	R	PO1
	PART-B (Ten Marks Questions)		
1	Draw and explain the construction and working principle of layout of diesel power Plant.	U	PO1
2	Explain various types of fuel injection systems in diesel power plant.	U	PO1
3	Explain fuel feed system in diesel power plant with neat sketch.	R	PO1
4	Explain cooling system in diesel power plant with neat sketch.	U	PO1
5	Explain lubrication system in diesel power plant with neat sketch.	U	PO1
6	Discuss the advantage and disadvantage of a diesel engine.	U	PO1
7	Explain the construction and working principle of gas turbine power plant and its applications.	U	PO1
8	Explain the working of gas turbine cycle with regenerator.	U	PO1
9	Draw and Explain the construction and working principle of Open cycle gas turbine power plant?	U	PO2
10	Draw and explain the construction and working principle of closed cycle gas turbine power plant?	U	PO2

	UNIT 3 – NUCLEAR POWER PLANT		
	PART-A (Two Marks Questions)		
1	What is critical mass of nuclear fuel?	R	PO1
2	What are isotopes?	R	PO1
3	Name the different types of fuels used in nuclear reactors.	R	PO1
4	What is known as binding energy?	R	PO1
5	How can nuclear fusion be caused?	R	PO1
6	Explain the function of nuclear reactor.	U	PO1
7	Why is shielding of a Nuclear reactor necessary?	R	PO1
8	Define the term “Breeding”.	R	PO1
9	Why is a liquid metal the preferred coolant in a fast breeder reactor?	R	PO1

10	What are the components of pressurized water reactor nuclear power plant?	R	PO1
11	What are the criteria used for evaluation of nuclear plant safety?	R	PO1
12	List some of the disadvantages of Nuclear power plant	R	PO1
13	How do you cater for safety of Nuclear power plant?	R	PO1
14	What are the advantages and disadvantages of breeder reactor?	R	PO1
15	What are the essential components of a nuclear reactor?	R	PO1
16	What are the conditions to be satisfied to sustain nuclear fission process?	R	PO1
17	How are the nuclear reactors classifieds?	R	PO1
18	Distinguish between PHWR and LMFBR.	R	PO1
19	What are the essential components of a nuclear reactor?	R	PO1
20	Name the three moderators commonly used in nuclear power reactor.	R	PO1
	PART-B (Ten Marks Questions)		
1	Explain the construction and working of nuclear power plant with a layout.	U	PO1
2	Explain the working of pressurized water reactor with neat sketch.	U	PO1
3	Explain with a neat sketch a boiling water reactor with neat sketch.	U	PO1
4	Explain CANDU (Canadian-Deuterium Uranium) reactor with neat diagram also mention its merits and demerits.	U	PO1
5	What is meant by uranium enrichened? Describe some methods of uranium enrichment.	R	PO1
6	Explain the different types of nuclear reactions and initiation of nuclear reactions	U	PO1
7	Explain the working of pressurized heavy water reactor.	U	PO1
8	Explain the working of gas cooled reactor.	U	PO1
9	Explain the working of High temperature gas cooled reactor.	U	PO1
10	Discuss about the safety measures adopted in modern nuclear plants.	E	PO1

	UNIT 4 – HYDRO-ELECTRIC POWER PLANT AND RENEWABLE ENERGY SOURCES		
	PART-A (Two Marks Questions)		
1	Write the principle of hydroelectric power plant works.	R	PO1
2	What is meant by water hammer?	R	PO1
3	Define Surge tank?	U	PO1
4	Write the purpose of Draft tube?	R	PO1
5	What are the Elements of Hydel Power Plant?	R	PO1
6	Write the Advantages of Hydro-electric power plants?	R	PO1
7	Define Governing Mechanism?	U	PO1
8	What is meant by hydrograph?	U	PO1
9	Write the advantages of small Hydro-power plant (SHP)?	R	PO1
10	Differentiate propeller and Kaplan turbine?	U	PO1
11	List various type of energy resources.	R	PO1
12	Write short notes on non-conventional energy.	R	PO1
13	Write short notes on geothermal energy.	R	PO1
14	List the advantages of liquid fuel.	R	PO1
15	What is meant by tidal energy?	R	PO1
16	Write short note on biogas plant.	R	PO1
17	Write short notes on solar water heater.	R	PO1
18	Write short notes on geothermal energy.	R	PO1
19	Write short notes on nuclear energy generation.	R	PO1
20	Write short notes on wind energy.	R	PO1
	PART-B (Ten Marks Questions)		

1	Draw the schematic layout of hydroelectric power plant and explain how the power will generate?	U	PO1
2	Explain with sketch pumped storage power plant.	U	PO1
3	Discuss the differences between Pelton, Francis and Kaplan turbines and which type of turbine is suitable in power plants for various criteria?	U	PO3
4	Why the inward flow reaction turbines have superseded the outward flow turbines?	R	PO1
5	What effects the efficiency of a reaction turbine on part-load? Is the part load efficiency is a function of specific speed?	R	PO1
6	What are solar cell technologies?	R	PO1
7	Briefly describe about ocean energy.	U	PO1
8	What is wind energy and wind mill system	R	PO1
9	Write down working of solar cells.	R	PO1
10	What are the features of biomass energy and describe what the source of biomass?	R	PO1

	UNIT 5 - ENERGY MANAGEMENT, ECONOMICS AND ENVIRONMENTAL ISSUES		
	PART-A (Two Marks Questions)		
1	Define load factor and utility factor?	R	PO1
2	Define plant operating factor and capacity factor?	R	PO1
3	Define demand factor and diversity factor?	R	PO1
4	What is the difference between demand factor and diversity factor?	R	PO1
5	How 'load duration curve' is obtained from 'load' curve?	R	PO1
6	Define 'depreciation' and explain its significance.	R	PO1
7	Differentiate 'dump power', 'firm power' and 'prime power'.	R	PO1
8	What is 'diversity factor'? List its advantages in a power system.	R	PO1
9	What do you know about environment pollution due to energy uses?	R	PO1
10	Define harmful effect of emission.	R	PO1
11	What are the step taken for reduce air pollution?	R	PO1
12	Write short notes on Noise pollution and its control.	R	PO1
13	What is acid rain, explain?	R	PO1
14	Write short notes on stratospheric ozone depletion, Acid Fog.	R	PO1
15	Write on pollution due to combustion of fuel.	R	PO1
16	What do you understand by liquid fuel pollution?	R	PO1
17	What do you understand by solid fuel pollution?	R	PO1
18	What are the various pollution standard followed by controlling of pollution to atmosphere?	R	PO1
19	Write the methods of wastage disposal in thermal power plants.	R	PO1
20	Write the methods of wastage disposal in nuclear power plants.	R	PO1
	PART-B (Ten Marks Questions)		
1	Explain environment pollution due to industrial emissions and road transport.	U	PO1
2	Explain environment pollution due to nuclear wastages and how to control it?	U	PO1
3	What are the greenhouse gases and explain their effects?	R	PO1
4	Briefly explain fossil fuel pollution.	U	PO1
5	What do you understand by thermal pollution, explain the bad effects of thermal pollution?	R	PO1
6	Explain how gas combustion polluted the atmosphere.	U	PO1
7	Prove that the load factor of a power system is improved by an increase in diversity of load.	E	PO1

8	Explain the sinking fund method of calculating the depreciation.	U	PO1
9	Discuss the factors to be considered for, 'plant selection' for a Power plant.	R	PO1
10	What is meant by load curve? Explain its importance in power generation.	R	PO1

*****ALL THE BEST*****