

**DEPARTMENT OF MECHANICAL ENGINEERING
QUESTION BANK**

Sub Code/Name: ME 1353 / Power Plant Engineering Year/Sem: III/ VI

UNIT-I INTRODUCTION TO POWER PLANTS AND BOILERS

PART A (2Marks)

1. What are types of power plants?
2. What do you understand by water hammer?
3. Discuss the essential factors which should be considered while selecting a site for a hydroelectric power plant?
4. State the advantages and disadvantages of the hydroelectric power plants.
5. List out the factors with which the unit size of the power plant is being decided.
6. What is the use of load curves in power plants?
7. Mention any two drawbacks of a stationary gas turbine power plant for generation of electricity.
8. What are the applications of diesel engine power plant?
9. Why is the maximum cycle temperature of gas turbine plant much lower than that of diesel power plant?
10. What are the different fields where use of diesel power plant is essential?
11. What is the purpose of air intake system in a diesel engine power plant?
12. What is the basic principle of a magneto hydro dynamic (MHD) generator?
13. How the nuclear reactors are classified?
14. What are the main units in a gas turbine power plant?
15. What is the function of economizer?
16. What is the use of regenerator?
17. Define super critical boilers.
18. List out the inherent advantages of the combined power cycles.
19. List out the major advantages of high pressure boiler in modern thermal power plants.
20. Explain the basic principle of FBC.
21. What are the methods of reheating?

UNIT-I INTRODUCTION TO POWER PLANTS AND BOILERS

PART-B (16 Marks)

1. Draw the general layout of thermal power plant and explain the working of different circuits. (16)
2. Sketch the layout of hydroelectric power plant and explain the functions of each component in it. Discuss the advantages and limitations of this plant. (16)
3. What are the factors to be considered while selecting a site for hydroelectric power plant? (16)
4. Explain the Gas turbine power plant with neat sketch. Discuss the advantages of gas turbine power plant (16)
5. Draw the layout of Diesel power plant. (16)
6. Explain the construction and working of Nuclear power plant with a layout. (16)
7. Draw the layout MHD open cycle generator and explain its functions of components. (16)
8. Discuss the various factors to be considered while selecting the site for nuclear power station. (16)
9. What are the advantages of reheat cycle over simple ranking cycle? (16)
10. Steam at 10bar and 0.95 dry is available. Find the final dryness fraction of steam for each of the following

operations using steam table:

- (i) 160 kJ of heat is removed per kg of steam at constant pressure.
- (ii) It is cooled at constant volume till its temperature falls to 1400C
- (iii) Steam expands isentropically in the steam turbine developing 200KJ of work per kg of steam flow and pressure becomes 0.5bar. (16)

11. A steam boiler generates steam at 30bar, 3000C at the rate of 2kg/s. This steam is expanded isentropically in a turbine to a consider pressure of 0.05bar, condensed at constant pressure and pumped back to boiler.

- a) Draw the schematic arrangement of the above plant and T-s diagram of Rankine Cycle.
- b) Find heat supplied in the boiler per hour
- c) Determine the quality of steam after expansion.
- d) What is the power generated by the turbine?
- e) Estimate the Ranking efficiency considering pump work. (16)

12. Draw a neat line diagram of Benson boiler and discuss its relative merits and demerits. (16)

13. With a neat sketch explain the working principle of Loeffler boiler. (16)

14. What are the advantages of high pressure boilers? (16)

15. What are the advantages of super critical boiler over critical boilers? (16)

16. Explain with neat sketch the principle of a commercial FBC system. (16)

17. Draw a line diagram of fluidized bed combustion system where steam turbine is used as a prime mover and explain its working. (16)

UNIT-II STEAM POWER PLANT

PART A (2Marks)

- 1. What are the methods used for handling of coal?
- 2. State the advantages and disadvantages of pulverized coal firing.
- 3. State the advantage of pulverized fuel firing.
- 4. What is the function of cooling tower?
- 5. What are the requirements of a modern surface condenser?
- 6. What is drift? How is the drift eliminated in the cooling towers?
- 7. What is pulverization?
- 8. What are the methods used in ash handling system?
- 9. What is the mechanism of pulverized fuel firing system?

UNIT-II STEAM POWER PLANT

PART-B (16 Marks)

- 1. a) Draw an explanatory line diagram of an ash handling system employed in steam power plants and also explain the difficulties encountered in the handling of ash in a thermal power station. (10)
- b) Explain the difficult types of coal handling process. (6)
- 2. a) Explain the principle involved in preparation of coal and what are the methods of preparation? (10)
- b) What are the different types of dust collectors used? (6)
- 3. What are the different types of pulverizing mills? Explain with its neat sketch. (16)
- 4. How ash is handled in the power plant? Explain the ash handling system. (16)
- 5. What are the methods used for pulverized fuel burning? (16)
- 6. Explain the various draught systems with a neat sketch. (16)

7. Explain the principle involved in design of chimney. (16)
8. What are the different types of cooling towers? Explain with a neat sketch. (16)
9. Explain the analysis of pollution from thermal power plants. (16)
10. What are the methods used for control the pollutants. (16)
11. Differentiate between forced draught and induced draught system in cooling tower. (16)

UNIT-III NUCLEAR AND HYDEL POWER PLANTS

PART A (2Marks)

1. What are the advantages of nuclear power plant?
2. What do you understand by moderation?
3. Explain the function of moderator?
4. Explain the function of nuclear reactor
5. List down the basic factors those are to be considered for the design of a nuclear power reactor.
6. What is "half life" of nuclear fuels?
7. List down the nuclear waste disposal method.
8. Define the term "Breeding"
9. What factors control the selection of a particular type of a reactor?

10. What are the components of pressurized water reactor nuclear power plant?

11. What are the micro hydel plants? Why are they important now days?
12. What is the function of a surge tank in a hydro electric power plant?
13. What is hydraulic turbine?
14. Give an example for a low head turbine a medium head turbine and a high head turbine.
15. What are reaction turbines? Give example.
16. Differentiate the impulse and reaction turbine.
17. Define unit speed of turbine.
18. Write the function of draft tube in turbine outlet?
19. What is a draft tube? In which type of turbine it is mostly used?
20. What is meant by surge tank?

UNIT-III NUCLEAR AND HYDEL POWER PLANTS

PART-B (16 Marks)

1. What is chain reaction? How it is maintained? What is the difference between controlled and uncontrolled chain reaction? Explain with neat sketches and with examples. (16)
2. a) Describes the boiling water reactor with the help of neat sketch and explain its chief characteristics. (10)
b) Discuss the salient features of the nuclear waste disposal. (6)
3. What is a chain reaction? How it is controlled? Explain with a neat sketch a boiling water reactor. (16)
4. a) Explain the working of a typical fast breeder nuclear reactor power plant, with the help of neat diagram (10)
b) Write short notes on Nuclear waste disposal (6)
5. a) What are the difference between a pressurized water reactor nuclear power plant and boiling water reactor nuclear power plant? (10)
b) What are the desirable properties of a good moderator? (6)
6. a) What are the advantages and disadvantages of nuclear power plant? (8)

- b) Explain with a neat sketch the indirect gas cooled reactor (8)
- 7.a) Explain the principle of operation of sodium graphite reactor. (8)
- b) Derive an expression for the maximum hydraulic efficiency in a impulse turbine (8)
- 8. a) Differentiate pelton wheel turbine with Francis turbine. (8)
- b) Compare radial flow and axial flow turbo machines. (8)
- 9. a) Define specific speed of a turbine. Derive an expression for the specific speed. (10)
- b) Explain the term unit power, unit speed and unit discharge with reference to a turbine (6)
- 10. Function of draft tube in turbines and the various types of draft tubes. (16)
- 11. Draw a layout of a typical micro hydro scheme and explain its working in detail. (16)

UNIT-IV DIESEL AND GAS TURBINE POWER PLANTS

PART A (2Marks)

1. What are the applications of diesel electric power plants?
2. What are the methods used for starting a diesel engine?
3. What are the components present in the diesel electric power plants
4. What is the commonly used fuel injection system in a diesel power station?
5. What are the methods of cooling in a diesel engine power plant?
6. Discuss the effect of inter cooling in a gas turbine plant.
7. What is the different between open cycle and closed cycle gas turbine plant?
8. How the gas turbine blades are cooled?
9. Why is the maximum cycle temperature of gas turbine plant much lower than that of diesel power plant?
10. Define mean effective pressure as applied to gas power cycles How it is related to indicated power of an I.C.engine?
12. Mention the various process of the Brayton cycle.
13. Draw the p-V and T-s diagram of Brayton cycle.
14. What is the principle of operation of simple jet propulsion system?
15. Sketch the schematic arrangement of open cycle gas turbine plant and name the components.

UNIT-IV DIESEL AND GAS TURBINE POWER PLANTS

PART-B (16 Marks)

1. Draw and explain the layout of a modern diesel power plant showing the following systems.
 - a. Air Intake system
 - b. Cooling system
 - c. Fuel supply system
 - d. Lubrication system and
 - e. Exhaust system. (16)
2. Describe the auxiliary equipments of a diesel engine power plant. what are the disadvantages of this plant (16)
Hint: Auxiliary equipments are
 - a. Pneumatic starter b. Air compressor. c. Air conditions and d. coolant circulation pump.
3. a). Explain the various types of cooling system used in diesel power plant (8)
- b). Name and explain briefly the various types of fuel injection system (8)
4. a). Give the layout of diesel engine power plant. What are the advantages and disadvantages of diesel power plants? (10)

- b). Describe briefly the commonly used starting system in large and medium size engines. (6)
5. a) Derive an expression for air standard efficiency of Brayton cycle in terms of (i) compression ratio and (ii) the pressure ratio. (10)
- b) Why is the Brayton cycle most suitable for gas turbine power? (6)
6. a). Bring out the difference between the closed cycle and open cycle gas turbine power plants (6)
- b). Draw a neat diagram of a regenerative gas turbine and reheater and also explain its working with the help of a p-v diagram. (10)
7. a) What are the methods used for improving the efficiency of a gas turbine plant? (4)
- b) Explain the working of any one type of combustion chamber used in gas turbine plant? (12)
8. Sketch the Brayton cycle. Air enters the compressor of the cycle at 1 bar and 250°C. Pressure after compression is 3 bar. Temperature at turbine inlet is 650°C. Determine per kg of air the (i) cycle efficiency (ii) heat supplied to air, (iii) work available (iv) heat rejected in the cooler and (v) Temperature of air leaving the turbine. (16)
9. a). With PV and TS diagram explain the effect of intercooling, reheating and regeneration in a gas turbine plant (10)
- b). Discuss the materials which are used for gas turbine and compressors. What properties should the blade materials possess? (6)
10. A gas turbine working on theoretical air cycle draws air initially at 250°C and 1 bar. The maximum pressure and temperature is 3 bar and 650°C. Calculate air standard efficiency, heat supplied, heat rejected, work output per kg of air exhaust temperature. (16)
11. In an air standard Brayton cycle, the air enters the compressor at 1 bar and 150°C. The pressure leaving the compressor is 5 bar, the maximum temperature in the cycle 900°C. Find the following
- a. Compressor and expander work per kg of air
- b. The cycle efficiency. If an ideal regenerator is incorporated into the cycle, determine the % change in efficiency. (16)
12. Consider a stationary power plant operating on an ideal Brayton cycle. The pressure ratio of the cycle is 8 and the gas temperature at the compressor inlet and turbine inlet are 270°C & 1027°C respectively. Determine the following :
- a. Gas temperature at the compressor and turbine exit
- b. Back work ratio and
- c. Thermal efficiency.
- Assume $pr_1 = 1.386$ and $pr_3 = 330.9$. Where, pr is the relative pressure. (16)

UNIT-V OTHER POWER PLANTS AND ECONOMICS OF POWER PLANTS

PART A (2Marks)

1. Mention the advantages and disadvantages of the geo – thermal power plant.
2. List out the advantages of tidal power plants over hydel power plant?
3. Mention the advantages and disadvantages of the OTEC power plant.
4. What is principle of OTEC?
5. What are the components of tidal power plant?
6. What is Heliostats?

7. What is the significance of incremental rate of a power plant?
8. What are the various operating cost of coal fired steam power plant?
9. Define "Diversity factor"
10. What is fixed cost and operating cost?
11. What is the significance of two part tariff and three part tariff?
12. What are the major factors that decide the economics of power plants?

UNIT-V OTHER POWER PLANTS AND ECONOMICS OF POWER PLANTS

PART-B (16 Marks)

1. Find the cost of generation per kW-hr from the following data.
Capacity of the plant - 120MW
Capital cost - Rs.1,200 per kW installed
Interest and depreciation - 10 %on capital
Fuel consumption - 1.2 kg / kW-hr.
Fuel cost - Rs. 40 tone
Salaries, wages, repairs and maintenance - 6, 00,000 / year
The maximum demand is 80 MW and load factor is 40 %. (16)
 2. A central power station has annual factors as follows:
Load factor = 60%
Capacity factor = 40%
Use factor = 45%
Power station has a maximum demand of 15,000kW.Determine; Annual energy production, Reserve capacity over and above peak load, Hours per year not in service. (16)
 3. A power station has two 60MW units each running for 1500hours a year. The energy produced per year is 700 x 10⁶ kW-hr. Calculate the plant load factor and plant use factor. (16)
 4. a) Sketch and explain the two pool tidal power plant (16)
b). Describe with help of neat sketch the working of a solar thermal receiver system plant and enumerate the advantages and disadvantages of concentrating collectors over flat plate collectors. (16)
 5. Discuss the different system used for generating power using geothermal energy. (16)
 6. What do you understand by power plant economics? Explain the fixed costs and operating costs of a power station. (16)
 7. What is meant by load factor and diversity factor? (16)
 8. What are the advantages and disadvantages of pumped storage system? (16)
 - 9.a). Explain working of hybrid OTEC system and what are the advantages? (16)
b). Enumerate and explain the various types of prime movers used in geothermal energy conversion systems. (8)
 10. What are the elements which contribute to the cost of the electricity? and how can the cost power generation be reduced? (16)
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