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**Question Paper Code : 80926**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Third/Sixth/Seventh Semester

Mechanical Engineering

ME 8792 – POWER PLANT ENGINEERING

(Common to : Electrical and Electronics Engineering/Safety and Fire Engineering)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Use of Steam table and Mollier chart are permitted

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is minimum fluidization velocity?
2. How is internal treatment of feedwater done?
3. A diesel engine has a brake thermal efficiency of 30%. If the calorific value of fuel used is 45000 kJ/kg, calculate the brake specific fuel consumption.
4. Why is power generation by gas turbines attractive these days?
5. What do you mean by mass defect and binding energy?
6. What are prompt and delayed neutrons?
7. Why is surge tank important in hydro-plant?
8. List the factors affecting the biogas production.
9. How is the load-duration curve constructed?
10. On what factors does the unit size of a power plant depend?

PART B — (5 × 13 = 65 marks)

11. (a) What is fluidized bed combustion system? Sketch and describe a Fluidized Bed Combustion (FBC) system. State the advantages of FBC system.

Or

- (b) Give the layout of a modern steam power plant and explain its various circuits.
12. (a) Describe the procedure of testing diesel power plant performance. How is plant maintenance carried out?

Or

- (b) Consider a simple ideal Brayton cycle with air as the working fluid. The pressure ratio of the cycle is 6, and the minimum and maximum temperatures are 300 and 1300 K, respectively. Now the pressure ratio is doubled without changing the minimum and maximum temperatures in the cycle. Determine the change in (i) the net work output per unit mass and (ii) the thermal efficiency of the cycle as a result of this modification.

13. (a) What is CANDU-type reactor? Explain with a sketch its main features.

Or

- (b) With a neat sketch and explain the working of gas cooled reactor.

14. (a) With the help of a schematic diagram, explain the

- (i) Horizontal axis aero generator, (4)  
(ii) Central receiver power plants (5)  
(iii) Principle of PV cell. (4)

Or

- (b) Write short notes on:

- (i) Hydrogen Fuel Cells, (4)  
(ii) Closed cycle OTEC, (4)  
(iii) Geothermal resources. (5)

15. (a) Calculate the cost of generation per kWh for a power station having the following data:

Installed capacity of the plant : 120 MW

Capital cost : Rs.  $96 \times 10^6$

Rate of interest and depreciation : 14%

Annual cost of fuel oil, salaries and taxation : Rs.  $12 \times 10^5$

Load factor : 40%

Also find the saving in cost per kWh if the annual load factor is raised to 50%.

Or

- (b) Discuss the various pollutants from the following :

(i) Atomic power plant (7)

(ii) Coal based steam power plant. (6)

PART C — (1 × 15 = 15 marks)

16. (a) Explain the method of generating electricity from biomass. With the help of typical biogas plant, explain the functions of the digester and dome and also discuss how animal wastes utilized to produce biogas. How can India benefit from the installation of biogas plants?

Or

- (b) A simple steam power cycle uses solar energy for the heat input. Water in the cycle enters the pump as a saturated liquid at 40 °C, and is pumped to 2 bars. It then evaporates in the boiler at this pressure, and enters the turbine as saturated vapour. At the turbine exhaust the conditions are 40 °C and 10% moisture. The flow rate is 150 kg/h. determine (i) the turbine isentropic efficiency, (ii) the net work output, (iii) the cycle efficiency, and (iv) the area of the solar collector needed if the collectors pick up 0.58 kW/m<sup>2</sup>.