Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 53317

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Fifth/Seventh Semester

Mechanical Engineering

ME 6701 — POWER PLANT ENGINEERING

(Regulation 2013)

(Common to Mechanical Engineering (Sandwich)/Electrical and Electronics Engineering)

(Also common to PTME 6701 — Power Plant Engineering for B.E. (Part-Time) Second Semester — Electrical and Electronics Engineering/Seventh Semester – Mechanical Engineering (Regulation 2014))

Time : Three hours Maximum : 100 marks

State clearly any assumption made with justification.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the need of modern coal based thermal power plants.

2. What are the two most commonly used methods for the burning of coal?

3. Draw a P-v and T-s diagram of Dual cycle.

4. Highlight the advantage of combine cycle power plant.

5. List out the desirable properties of a moderator.

6. On a global-scale perspective brief out how nuclear energy is possible to replace the fossil fuel combustion based power plants.

7. What do you mean by 'hydrological cycle'?

8. How solar inverter plays a vital role in solar PV based power plant?

9. What are the methods adopted by the thermal power plants to reduce the NOx emission?

10. Distinguish between demand factor and load factor.

PART B — (5 × 13 = 65 marks)

11. (a) (i) What is circulation and circulation ratio? (5)

(ii) With a neat sketches discuss the function of various circulation systems. (8)

Or

(b) When a boiler is called as high pressure boiler? Describe the advantages, construction and working of any one high pressure boiler.

12. (a) Draw a layout of Diesel engine power plant and discuss the various auxiliary equipments involved in this plant.

Or

(b) Draw a layout of IGCC plant and describe its function and its merits.

13. (a) (i) List out the factors to be followed for site selection nuclear power plant. (8)

(ii) Calculate the fission rate of U^{235} for producing power of one watt if 200 MeV if energy is released per fission of U^{235}. (5)

Or

(b) (i) Discuss the need of control rods and their desirable properties. (8)

(ii) List out the basic factors to be considered for design of nuclear power reactor. (5)

14. (a) What is Fuel cell? Why Fuel cells employed for power generation? Also discuss the working principle of fuel cell.

Or

(b) Discuss the function of concentrating solar collectors. Also briefly explain how electrical energy is generated in solar power plant using these collectors.

15. (a) (i) A steam power station has an installed capacity of 120 MW and a maximum demand of 100 MW. The coal consumption is 0.4 kg per kWh and cost of coal is Rs. 80 per tonne. The annual expenses on salary bill of staff and other overhead charges excluding cost of coal are Rs. 50×10^5. The power station works at a load factor of 0.5 and the capital cost of the power station is Rs. 4×10^5. If the rate of interest and depreciation is 10% determine the cost of generating per kWh. (8)

(ii) Determine the thermal efficiency of a steam power plant and its coal bill per annum using the following data : (5)

Maximum demand = 24000 kW

Load factor = 40%

Boiler efficiency = 89%

Turbine efficiency = 93%

Coal consumption = 0.87 kg/Unit

Price of coal = Rs. 280 per tonne.

Or

(b) (i) Distinguish between base and peak load power plant. List the requirements of base load and peak load power plants. (8)

(ii) What is load curve? What do you infer from the load curve? (5)

PART C — (1 × 15 = 15 marks)

16. (a) A gas turbine plant of 800 kW capacities takes the air at 1.01 bar and 15°C. The pressure ratio of the cycle is 6 and maximum temperature is limited to 700°C. A regenerator of 75% effectiveness is added in the plant to increase the overall efficiency of the plant. The pressure drop in the combustion chamber is 0.15 bar as well as in the regenerator is also 0.15 bar. Assuming the isentropic efficiency of the compressor 80% and of the turbine 85%, determine the plant thermal efficiency. Neglect the mass of the fuel.

Or

(b) The annual cost of operating a 15 MW thermal power station are as follows:

Cost of plant = Rs. 900 per kW

Interest, insurance taxes on plant = 5%

Depreciation = 5%

Cost of primary distribution system = Rs. 5,00,000

Interest, insurance, taxes and depreciation on primary distribution system = 5%

Cost of secondary distribution system = Rs. 9,00,000

Interest, insurance, taxes and depreciation on secondary distribution system = 5%

Plant Maintenance cost: (i) Fixed cost = Rs. 30,000 (ii) Variable cost = Rs. 40,000

Operating costs = Rs. 6,00,000

Cost of coal = Rs. 60 per tonnes

Consumption of coal = 30,000 tonnes

Dividend to stock-holders = Rs. 10,00,000

Energy loss in transmission = 10%

Maximum demand = 14 MW

Diversity factor = 1.5

Load factor = 70%

Device a two-part tariff.
