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Question Paper Code : 80987

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2025.

Fifth/Sixth/Eighth Semester

Mechanical Engineering

CME 384 — POWER PLANT ENGINEERING

(Common to : Electrical and Electronics Engineering)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is a supercritical power plant?
2. Define mean temperature of heat addition.
3. Compare the efficiency of a simple Brayton cycle, possessing a pressure ratio of 10, operating with fluids having adiabatic index of 1.4 and 2.4.
4. Differentiate: combine cycle and binary cycle power plant
5. List any two critical factors considered for locating a Nuclear Power Plant.
6. Mention any two significant characteristics to be possessed by a control rod in a nuclear power plant.
7. Distinguish : renewable energy and non-renewable energy.
8. Why fuel cells are not widely adopted for large scale power generation?
9. Depict a typical “cyclone separator” employed for controlling SPM.
10. How power tariffs are classified?

PART B — (5 × 13 = 65 marks)

11. (a) Find the thermal efficiency and specific work of a simple Rankine cycle if the maximum temperature and pressure are 540°C and 70 bar and the minimum pressure is 0.1 bar. Assume turbine and pump efficiencies as 85%.

Or

- (b) Explain the working of a typical binary cycle power plant with a suitable layout diagram and T-S plot. List its advantages over singular cycles.
12. (a) With suitable T-S plots, compare the thermodynamic processes employed in Rankine and Brayton cycle. Also comment on the statement: "Auxiliary power consumption in Brayton Cycle is significantly higher than Rankine Cycle".

Or

- (b) With a suitable schematic, explain the working of a typical IGCC power plant.
13. (a) Explain the working principle of a typical nuclear power plant and describe the function of different associated components.

Or

- (b) Compare the principle, working, merits and demerits of CANDU over PWR systems.
14. (a) With a neat layout, explain the construction and working of a double basin tidal power plant.

Or

- (b) With a suitable block diagram, brief on the working of a typical grid independent solar-power plant.
15. (a) Brief on the operating principle of any four air pollution control technologies.

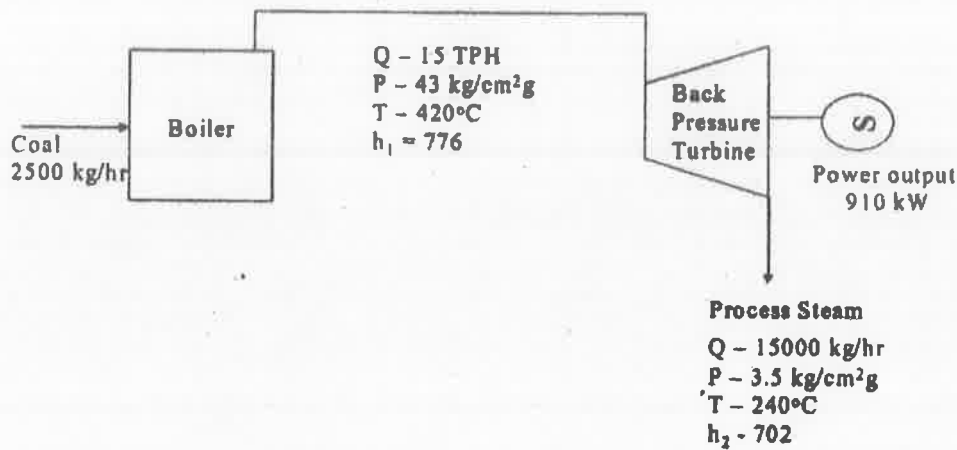
Or

- (b) The peak load on a power plant is 60 MW. The loads having maximum demands of 30 MW, 20 MW, 10 MW and 14 MW are connected to the power plant. The capacity of the power plant is 80 MW and the annual load factor is 0.50. Estimate the following :
- (i) the average load on the power plant
 - (ii) the energy supplied per year
 - (iii) the demand factor and
 - (iv) diversity factor.

(3+3+3+4)

PART C — (1 × 15 = 15 marks)

16. (a) A medium size paper plant having an average production 120 MT/h of Kraft paper is having a cogeneration system with a back pressure turbine. The plant steam and electrical demands are 15 TPH and 910 kW. The process flow diagram is given below. Gross calorific value of Indian coal is 4000 kcal/kg, average fuel consumption (boiler) is around 2.5 TPH. Efficiency of alternator and gear transmission are 92% and 98%, respectively. Evaluate efficiency of turbine and overall plant fuel rate. Hint: 1 kcal = 4.186 kJ and value of h in figure is in kcal/kg.



Or

- (b) Compute the cost for generating 1 unit of electricity from the following power plants
- coal based power plant
 - diesel power plant
 - wood based IGCC plant

Assume prevalent cost of fuel and suitable conversion efficiency of respective power plants.

