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Name.........................

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SEVENTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, JUNE 2013

ME/PT ME 09 704 – POWER PLANT ENGINEERING

(2009 Scheme – Supplementary)

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*

Each question carries 2 *marks.*

1. What is meant by T-S diagram? Draw the T-S diagram of Rankine Cycle.
2. What is meant by compounding of a turbine?
3. List the types of various cooling towers.
4. What are the advantages of Circulating Fluidised Bed boilers (CFB)?
5. What is meant by half-life period?

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

Each question carries 5 *marks.*

6. What is meant by temperature of heat addition? What is its effect on cycle efficiency?
7. What is cogeneration of power and process heat? Explain its thermodynamic advantage.
8. What is LaMont Boiler? Explain with a simple sketch.
9. What is circulation? Differentiate natural circulation and forced circulation with suitable examples.
10. What are primary and secondary superheaters?
11. What is (a) Straight Line Method ; Sinking Fund Method?

(4 × 5 = 20 marks)

Part C

Each question carries 10 *marks.*

12. (a) A steam power station uses the following cycle : Steam at boiler outlet ; 150 bar, 550° C. Reheat at 40 bar to 550° C. Condenser at 0.1 bar. Assuming ideal processes find (i) The quality at turbine exhaust ; (ii) The cycle efficiency ; and (iii) Steam rate.

Turn over

(b) A 10 MW steam turbine operates with steam at 40 bar, 400 °C at the inlet and exhaust at 0.1 bar. 10000 kg/h of steam at 3 bar are to be extracted for process work. The turbine has 75% isentropic efficiency throughout. Find the boiler capacity required.

Or

13. Steam at 40 bar, 500 °C flowing at the rate of 5500 kg/h expands in a h.p. turbine to 2 bar with an isentropic efficiency of 83%. A continuous supply of steam at 2 bar, 0.87 quality and a flow rate of 2700 kg/h is available from a geothermal energy source. This steam is mixed adiabatically with the h.p. turbine exhaust steam and the combined flow then expounds in a l.p. turbine to 0.1 bar with an isentropic efficiency of 78%. Determine the power output and the thermal efficiency of the plant. Assume that 5500 kg/h of steam is generated in the boiler at 40 bar, 500 °C from the saturated feed water at 0.1 bar. Had the geothermal steam not been added. What would have been the power output and efficiency of the plant? Neglect the pump work.

(10 Marks)

14. The angles at inlet and discharge of the blading of a 50% reaction turbine are 35° and 20° respectively. The speed of rotation is 1500 r.p.m. and at a particular stage, the mean ring diameter is 0.67 m and the steam condition is at 1.5 bar 0.96 dry. Estimate (a) The required height of blading to pass 3.6 kg/s of steam ; and (b) The power developed by the ring.

Or

15. With a neat sketch explain the working of an ash handling system.

(10 Marks)

16. Sketch and explain any one fire tube boiler.

Or

17. A boiler plant incorporates an economiser and air preheater and generates steam at 40 bar and 300 °C with fuel of heating value 33000 kJ/kg burned at a rate of 500 kg/hr. The temperature of feed water is raised from 40 °C to 125 °C in the economiser and the flue gases are cooled at the same time from 395 °C to 225 °C. The flue gases then enter the air preheater in which the temperature of combustion air is raised by 75 °C. A forced draught fan delivers the air to the air preheater at a pressure of 1.02 bar and a temperature of 16 °C with a pressure rise across the fan of 180 mm of water. The power input to the fan is 5 kW and it has a mechanical efficiency of 78%. Neglecting heat losses and taking C_p as 1.01 kJ/kgK for flue gases, calculate (a) The mass flow rate of air ; (b) The temperature of flue gases leaving the plant ; (c) The mass flow rate of steam ; and (d) The efficiency of boiler.

18. Explain (a) Various costs in power plant economics ; (b) Economic scheduling principle ; (c) Depreciation.

Or

19. (a) Explain merits, demerits of fast breeder reactors and gas cooled reactors.

(b) Explain MHD plant as a cyclic heat engine.

(4 × 10 = 40 marks)