D 50548 (Pages : 2) Name.....

Reg. No.....

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

ME 09 704—POWER PLANT ENGINEERING

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*

1. Differentiate regeneration and cogeneration.
2. Give any *two* measures for pollution control in the case of a thermal power plant.
3. What is super critical steam generator ?
4. What is load curve ? Give an example.
5. What are the types of cooling towers ?

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

6. What are the various types of combined cycle plants ? What are the inherent advantages of such a plant ?
7. Explain the effect of regeneration on steam cycle output and efficiency. Why ideal regenerative cycle is not practicable ?
8. Explain by-pass governing in a steam turbine.
9. What is meant by (a) Critical pressure ratio ; (b) Chocked flow.
10. What is a fusible plug ? Why it is used ?
11. Explain any one method to calculate depreciation.

(4 × 5 = 20 marks)

Part C

12. In a combined power and process plant the boiler generates 21,000 kg/h. of steam at a pressure of 17 bar and temperature 230° C. Apart of the steam goes to a process heater which consumes 132.56 kW, the steam leaving the process heater 0.957 dry at 17 bar being throttled to 3.5 bar. The remaining steam flows through an h.p. turbine which exhausts at a pressure of 3.5 bar. The exhaust steam mixes with the process steam before entering the l.p. turbine, which develops 1337.5 kW. At the exhaust the pressure is 0.3 bar and the steam is 0.912 dry. Draw the line and T-s diagrams of the plant and determine (i) the steam quality at the exhaust of the h.p. turbine ; (ii) The power developed by the h.p. turbine and (iii) The isentropic efficiency of the h.p. turbine.

Or

Turn over

13. In a cogeneration plant, 10^6 kg./h of steam at 80 bar, 480° C. expands in the h.p. turbine to 10 bar. From the exhaust 4×10^5 kg./h. of steam is extracted for process heating. The remaining steam expands in the l.p. turbine to 0.08 bar. Saturated liquid at 0.08 bar leaving the condenser is pumped to 9.5 bar where it mixes with the condensate from the process heater leaving at 9.5 bar, 120° C. The entire flow is then pumped to 80 bar. The isentropic efficiencies of the turbines and the pumps are 86 % and 80 %. respectively. Determine (i) The heating load, in kJ/h. ; (ii) the power developed by the turbines in kW ; and (iii) The rate of heat transfer in the steam generator in kJ/h.

14. How pollution happens in a thermal power plant ? What are the measures taken for pollution control in thermal plants ? Explain

Or

15. A steam turbine is to develop 8 MW at 5000 r.p.m. for driving a compressor. The steam enters at a 40 bar, 500° C. and exhausts at 0.1 bar. The internal efficiency of the turbine is 0.85 and its mechanical efficiency is 0.96. Estimate (a) The number of impulse stages required, if similar impulse stages and used throughout. (b) The nozzle height for the first stage with full admission. Assume nozzle efficiency as 0.92 nozzle angle 150°, limiting blade velocity 300 $ms.^{-1}$ and the blades operating at maximum efficiency.

16. (a) Explain the advantages of high pressure boilers. (5 marks)

    (b) What are the specialities of a bent tube boiler ? (5 marks)

Or

17. Explain the function of a tubular air preheater. Also give the temperature profiles.

18. With a neat sketch, explain the working of a fast breeder reactor.

Or

19. (a) A power plant has the following annual factors, load factor = 0.75 capacity factor = 0.6. Use factor = 0.65. Maximum demand is 60 MW. Estimate the (i) Annual energy production ; (ii) The reserve capacity over and above the peak load ; and (iii) Hours during which the plant is not in series per year. (5 marks)

    (b) Define reserve factor. How does it fix the maximum unit size ? (2 marks)

    (c) What are fixed costs ? (3 marks)

[4 × 10 = 40 marks]