(67)

B.E / B.Tech. (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2012

MECHANICAL ENGINEERING BRANCH

SIXTH SEMESTER

ME 382 – THERMAL ENGINEERING II

(REGULATIONS 2004)

Time: 3 hr Max Mar: 100

Instructions: 1. Use of steam table, Refrigeration table and Psychrometric chart permitted

Answer ALL Questions

PART – A (10 x 2 = 20 Marks)

1. Write the expression for the critical pressure ratio.
2. What is supersaturated flow?
3. What are the uses of compressed air?
4. Define volumetric efficiency of a compressor.
5. Draw the Psychrometric chart showing cooling and dehumidification process.
6. Define the RSHF and GSHF.
7. Define the term equivalent evaporation.
8. What is the function of superheater?
9. Define the term cogeneration.
10. List down the applications of cogeneration.

PART – B (5 x 16 = 80 Marks)

11 a (i) Prove that maximum discharge in a steam nozzle per unit area at the throat is given by, (10)

$$m_{max} = [1000\ n \times (p_1/v_1)(2/n+1)^{n+1/n-1}]^{1/2}$$

(ii) Steam at a pressure of 10 bar and 210°C is supplied to a convergent divergent nozzle with a throat area of 15 cm^2. The exit is below critical pressure. Find the coefficient of discharge, if flow is 7200 kg of steam per hour. (6)

12 a. A two stage single acting air compressor having capacity 4.5 m^3/min measured under free air conditions of 1.01325 bar and 15°C. The pressure during the suction stroke is 0.98 bar. The temperature of air at the start of compression in each stage is 27°C. The delivery pressure is 15 bar. The clearance volume in low pressure cylinder is 5% of the stroke. The index of compression and expansion is 1.3 and speed is 140 rpm. The intercooler pressure is such that the work is shared equally between the two cylinders. (16)

Determine (a) the indicated power, and (b) the diameter and stroke of low pressure cylinder if bore is equal to the stroke.

(Or)

b. (i) Compare centrifugal and axial flow compressor. (4)
(ii) List the advantages of multi-stage compression. (4)
(iii) Derive the expression for minimum work required per cycle. (8)

13 a. A refrigerator using atmospheric air and working on reversed joule cycle works between pressures of 1.01325 bar and 8.106 bar. The temperature of air entering the compressor is 10°C and after compression the air is cooled to 27°C before entering the expansion cylinder. Both expansion and compression are according to the law $PV^{1.3}$ = constant. Determine the theoretical COP of the machine. Take Cp = 1.005 kJ/kg K and Cv = 0.718 kJ/kg K (16)

(Or)

b. Explain the working of vapour compression refrigeration system and Electrolux refrigerator system with neat sketch. (16)

14 a. Explain the construction and working of Cochran boiler with neat sketch indicating various mounting installed on the boiler and explain the functions of each mounting. (16)

(Or)

b. The following observations were taken during a test on a steam boiler. (16)
Quantity of coal burnt/hour =750 kg
Feed water supplied/ hour = 7000 kg
Calorific value of coal fired = 33910 kJ/kg
Steam pressure = 9.8 bar
Feed water temperature entering economizer = 25°C
Feed water temperature leaving economizer = 80°C
Dryness fraction of steam leaving boiler drum = 0.95
Temperature of steam leaving superheater = 250°C
Determine the thermal efficiency of the plant; also calculate the heat absorbed by feed water in economizer, boiler drum and superheater as a percentage of the total heat absorbed.

15 a. Discuss about cogeneration of power and process heat, Back pressure turbine and Pass-out turbine. (16)

(Or)

b. Explain in detail about Utilization of waste heat and waste heat recovery systems. (16)