B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL /MAY 2011

MECHANICAL ENGINEERING BRANCH

SIXTH SEMSTER – (REGULATIONS 2004)

ME 382 – THERMAL ENGINEERING – II

Time: 3 hrs Max Mark: 100

(Use of steam table and Refrigeration table permitted)

Answer ALL Questions

Part – A (10 x 2 = 20 Mark)

1. What is the effect of friction in a steam nozzle?
2. Explain why nozzles are made convergent – divergent?
3. Why inter-cooling is necessary in multi-stage compression?
4. Define volumetric efficiency.
5. List out the advantages of vapor compression refrigeration system over air-refrigeration system.
6. Define RSHF, GSHF and ESHF.
7. Draw T-s diagram of Rankine cycle using dry-saturated steam.
8. What are the major differences between mountings and accessories?
9. Define the term cogeneration.
10. What are the thermodynamic advantages of such plant?

Part – B (5 x 16 = 80 Mark)

11 Supersaturated expansion occurs in a nozzle supplied with steam at $2MN/m^2$ and 25°C. The law for the expansion may be taken as $pv^{1.3}$ = constant upto exit pressure of $0.36 MN/m^2$. For a flow rate of 450 kg/min determine (i) the throat and exit areas and (ii) the degree of under-cooling at the exit. **(16)**

12(a) A single acting two stage compressor with complete inter-cooling delivers 10 kg/min of air at 16 bar. The suction occurs at 1 bar and 15°C. The compression and expansion processes are reversible polytrophic with polytrophic index n=1.25 calculate (a) The power required (b) the isothermal efficiency (c) the free air delivery (d) heat transferred in intercooler (e) if the clearance ratios for LP and HP cylinders are 0.04 and 0.06 respectively, calculate the swept and clearance volumes for each cylinder. **(16)**

(or)

(b) A two-stage double acting air compressor delivers air at a rate of 1.35 kg/sec. The suction pressure is 1 bar and interstage pressure is 7 bar and delivery pressure 42 bar. Air enters the L.P cylinder at 17°C and cooled in the inter cooler to 32°C. the clearance in L.P and H.P cylinders are 6% and 8% of the respective strokes. The law of compression and re-expansion is $pv^{1.21}$ = C. in both cylinders. Speed of the compressor is 500 rpm. Find (i) The amount of cooling water required per minute in intercooler, if rise in temperature of water is limited to 20°C. (ii) Power required. (iii) D and L of the L.P cylinder if L=D. **(16)**

13(a) In an ammonia refrigeration plant working on vapour compression cycle the pressure of the liquid before throttling is 12.542 bar and its temperature is 27.2°C. The pressure in the evaporator is constant 2.527 bar and the temperature at the exit from **(16)**

evaporator is -9.5°C. Ammonia circulating through the plant is 0.435 kg/min and the power of the compressor is 2 kW. Estimate (i) condition of ammonia before entering evaporator (ii) heat extracted per minute and (iii) COP. Take specific heat of liquid t 12.542 bar as 4.77 kJ/kg K and the specific heat of vapor at 2.527 bar at constant pressure as 2.5 kJ/kg K. use the data given below.

Properties of ammonia:

Saturation temperature °C	Pressure Bar	Specific enthalpy kJ/kg	
		Sat liquid, h_f	Sat vapor, hg
-13	2.527	121.26	1427.557
33	12.542	337.14	1469.56

(Or)

(b) Explain with neat sketch the working principle of vapor absorption system and Thermo-electric refrigeration system. **(16)**

14(a) Explain with neat sketch the construction and working principle of Lamont and Babcock-Wilcox boilers. **(16)**

(Or)

(b) Describe the following boiler Mountings and their functions with neat sketch. **(16)**

(i) Safety valve (ii) Water level Indicator (iii) Fusible plug (4) Pressure gauge

15(a) Discuss about the source and utilization of waste heat and waste heat recovery systems. **(16)**

(Or)

(b)(i) Explain cogeneration principles and its application. **(10)**

(ii) What is pass-out turbine? When it is used? **(6)**