(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 140603 Roll No. ☐☐☐☐☐☐☐☐☐☐

B.Tech.

(SEM. VI) THEORY EXAMINATION 2013-14

REFRIGERATION & AIR CONDITIONING

Time : 3 Hours   *Total Marks : 100*

Note :– (1) Attempt **all** questions, each question carries equal marks.

(2) Use of refrigerant tables, chart, psychrometric chart and h-c chart of mixtures is permitted.

1. Attempt any **two** of the following :   (10×2=20)

(a) Attempt the following :

(i) Discuss the effect of variation of evaporator and condenser temperatures on the C.O.P. of carnot cycle.

(ii) Differentiate open and closed air refrigeration system mentioning their merits and demerits.

(b) A refrigeration system working on reversed Brayton cycle operates between 1 bar and 5 bar. The temperatures at the inlet to the compressor and expander are 30°C and 40°C, respectively. Isentropic efficiency for the compression is 0.8 and same for expansion is 0.9. If the capacity of the system is 5 Tons of refrigeration, determine

(i) mass flow rate of air

(ii) power input to the compressor.

    Take : r = 1.4 and C_p = 1.004 kJ/kgK.

(c) Explain the working of Boot-strap air cooling system with the help of T-s diagram .

2. Attempt any **two** of the following :   （10×2=20）

(a) The temperature limits of an ammonia refrigerating system are 25°C and −10°C. If the gas is dry at the end of compression, calculate the coefficient of performance of cycle assuming no under cooling of the liquid ammonia. Use the following table for properties of ammonia :

Temp °C	Liquid heat (kJ/kg) (hf)	Latent heat (kJ/kg) (hfg)	Liquid Entropy (kJ/kgk)(s+)
25	298.9	1166.94	1.1242
−10	135.37	1297.68	0.5443

(b) Describe a simple vapour compression refrigeration system with the help of P–H and T–S diagrams. Also show the effect of following parameters on the performance of the system :

(i) Superheating of refrigerant vapour

(ii) Subcooling of condensate.

(c) What is multi-stage vapour compression refrigeration system ? Compare it with cascade refrigeration system. Explain advantages and disadvantages over simple vapour compression system.

3. Attempt any **two** of the following : (10×2=20)

   (a) Draw a neat labelled sketch of a Practical Vapour Absorption refrigeration cycle and explain its working in brief.

   (b) Attempt the following :

      (i) What are the desirable properties of an ideal refrigerant.

      (ii) Discuss in detail, the secondary refrigerants.

   (c) A stream of 20 kg/s of aqua-ammonia [c_1 = 0.8] at 0°C and 5 bar mixes adiabatically with another saturated liquid stream with the flow rate 20 kg/s and 80°C at the same pressure. Establish the state points on h-c diagram and obtain :

      (i) mixture concentration

      (ii) mixture enthalpy and

      (iii) amount of liquid and vapour after mixing.

4. Attempt any **two** of the following : (10×2=20)

   (a) Define the terms :

      (i) Dew point temperature

      (ii) Specific humidity

      (iii) Relative humidity

      (iv) Degree of saturation

         Air at 20°C, 40% RH is mixed adiabatically with air at 40°C and 40% RH in ratio of 1 kg of former to 2 kg of later. Find the final condition of air.

(b) Air conditioning was to be provided for a public hall :

Outdoor condition 40° DBT, 20°C WBT, seating capacity = 1000, Required comfort condition (20°C DBT), 50% RH, Air supplied = 0.3 m³/min/person. Air undergoes adiabatic humidifying process followed by simple cooling process. Bypass factor of coil is 0.25.

Find :

(i)   Capacity of cooling coil

(ii) Surface temperature of cooling coil

(iii) Capacity of humidifier.

(c) Explain the factors which affect human comfort. What is the use of comfort chart for comfort air conditioning.

5. Attempt any **two** of the following :   (10×2=20)

(a) What is expansion device, classify them. Also explain the working of thermostatic expansion value.

(b) Explain the working and constructional detail of a cooling tower.

(c) Write notes on frictional losses and dynamic losses in a flow through a duct. Write the expression for frictional pressure drop in ducts.