SEAT No. :

P5994

BE/Insem./Oct.-519

B.E. (Mechanical)

HEATING VENTILATION AND AIR-CONDITIONING

(2015 Pattern) (Elective - I)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates:

1) *Answer three questions out of 6.*

2) *Solve Q.1 or 2, Q.3 or 4, Q.5 or 6.*

3) *Draw diagrams wherever necessary.*

4) *Use of scientific calculator is allowed.*

5) *Assume suitable data wherever necessary.*

Q1) a) Explain Vortex tube expansion cycle. **[5]**

b) Discuss the thermodynamic analysis of ejector refrigeration cycle. **[5]**

OR

Q2) In HCFC-22 ejector refrigeration system, the motive vapour is saturated at 100°C, & vapour generated in evaporator at 6°C. The mass ratio of motive vapour to refrigerant vapour is 3.5. Find the quality of mixture before & after diffuser. The condensation of vapour in condenser is taken place at 30ºC. Also find cooling capacity & COP of system, when heat supplied in generated is 2 kW.

Take nozzle efficiency = 0.85, diffuser efficiency = 0.8, entrainment efficiency = 0.65.

T_{sat}(°C)	h_f(kJ/kg)	h_g(kJ/kg)	s_f(kJ/kg.K)	s_g (kJ/kg.K)
6	207.05	407.45	1.0254	1.7432
30	236.31	414.18	1.1253	1.7120
100	369.00	403.08	1.5007	1.6909

[10]

Q3) a) Explain the performance characteristic curves of reciprocating compressor. **[6]**

b) Write a short note on Liquid Charge in the Sensing Bulb. **[4]**

Q4) For a particular Direct Expansion Chiller, design details are as follows: **[10]**

Refrigerant-HCFC 22, Cooling capacity-20 TR

Effective tube length-221.5 cm, Diameter of tubes - 1.905 cm OD, 1.704 cm ID

Number of refrigerant passes - 8

Entering water temperature - 11.1°C, Leaving water temperature-7.2°C.

Refrigerant temperature at inlet-2.2°C, Condensing temperature-43.3°C

The water-side heat-transfer coefficient h_o may be taken as 4,650 W/m²K.

The refrigerant side coefficient may be approximated by $hi = 230.\Delta t$ W/m²K.

Find the number of tubes in the last pass. Assume equal enthalpy change in all passes. Neglect the thickness & thermal resistance of the tube wall.

Q5) a) What are the requirements of piping design for reciprocating refrigeration systems? **[5]**

b) Discuss the various methods of capacity controls of centrifugal compressor. **[5]**

OR

Q6) Explain the followings:

a) Performance characteristics of the condensing unit. **[6]**

b) Motor over current protection. **[4]**

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