

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 30°C. 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.

$T_{\text{sat}} (^{\circ}\text{C})$	$h_f (\text{kJ/kg})$	$h_g (\text{kJ/kg})$	$s_f (\text{kJ/kg.K})$	$s_g (\text{kJ/kg.K})$
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]

P.T.O.

OR

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 $h_i = 230 \Delta t$ W/m² K.

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]

