

Total No. of Questions : 12]

SEAT No. :

P4001

[Total No. of Pages : 6

[5353]-2

T.E. (Mechanical)

REFRIGERATION AND AIR-CONDITIONING

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Use of psychrometric chart is allowed.*
- 7) *Assume Suitable data if necessary, state clearly the assumption made.*

SECTION - I

- Q1)** a) Present various processes of vapour compression cycle on T-s and p-h diagram. Name the various processes and derive expression for COP. **[8]**
- b) Discuss the working of vortex tube refrigeration with neat diagram. What are the limitations of this system over other types? **[8]**

OR

- Q2)** a) Explain the application of refrigeration systems for: **[8]**
- i) dairy plant
 - ii) cold storage
- b) Dense (close) air refrigeration operates between pressures of 4 bar and 16 bar. The air temperature after heat rejection to surrounding is 37°C and air temperature at exit of refrigerator is 7°C. The isentropic efficiency of turbine and compressor are 0.85 and 0.8 respectively. Determine **[8]**
- i) Compressor and turbine work per TR;
 - ii) C.O.P and;
 - iii) Power required per TR. For air take $\gamma = 1.4$, and $C_p = 1.005 \text{ kJ/kg K}$.

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- Q3)** a) Discuss the effect of suction superheat and condenser subcooling on performance of VCC with the help of p-h or T-s diagram. [8]
- b) A 20 TR vapour compression system has evaporation temperature of 0°C and condensation temperature is 40°C. Determine: [8]
- The mass flow rate of refrigerant.
 - Power required to run the compressor,
 - COP of the system.

Use the properties:

Temp °C	Pressure bar	h_f kJ/kg	h_g kJ/kg	s_f kJ/kg	s_g kJ/kg.K
0	3.08	36.05	187.53	0.142	0.696
40	9.60	74.59	203.2	0.727	0.682

Take C_p for superheated vapour as 0.65 kJ/kg.K.

OR

- Q4)** a) Draw neat diagram of water-ammonia refrigeration system. Explain its working. What is the use of analyser and rectifier in this system? [8]
- b) Draw actual vapour compression cycle with the help of T-s and p-h diagram. Explain its working. [8]
- Q5)** a) Explain Montreal Protocol and Kyoto Protocol. [6]
- b) Explain pumped circulation system with neat diagram. [8]
- c) Explain the advantages of using flash chamber in parallel with evaporator. [4]

OR

- Q6)** a) A vapor compression system using ammonia as refrigerant works between 2 bar and 14 bar. Two flash chambers are fitted in the system at 6 bar and 10 bar and vapours are sent to the respective compressors where these compressors handle only flash gas. If the load on the evaporator is 18 TR, find the power required to run system and its COP. [10]
- What is the COP if it works on simple saturated VCC?
- b) Classify the refrigerants. Give alternatives refrigerants to HCFCs and HFCs. [8]

SECTION - II

- Q7)** a) List psychometric processes and present the analysis of any two processed in detail. [6]
- b) Define the “human comfort” and describe the factors which affect the human comfort. [6]
- c) The amount of air supplied to an air conditioned hall is 300 cmm. The atmospheric conditions are 35° C DBT and 55% RH. The required conditions are 20° C DBT and 60% RH. Find the Sensible Heat and Latent Heat removed from air per minute. [6]

OR

- Q8)** a) Explain ASHRAE comfort chart. [6]
- b) A psychomotor recorded 36°C DBT and 30°C WBT. Calculate [6]
- i) vapor pressure
 - ii) relative humidity
 - iii) specific humidity
 - iv) degree of saturation
 - v) dew point temperature
 - vi) enthalpy of the mixture, if atmospheric pressure is 100 kPa.
- c) Explain: RSHE, GSHE and ESHF. [6]

- Q9)** a) Draw the constructional details of TEV. Explain the working of same. [8]
- b) Give the procedure of installation and testing of central air conditioning system. [8]

OR

- Q10)** a) Explain the working of rolling piston and rotating vane type rotary compressor. Explain the advantages and disadvantages over each other. [8]
- b) Explain different types of evaporators used in refrigeration system. [8]

Q11)a) A circular duct of 400 mm is selected to carry air in an air conditioning space at a velocity of 440 m/min to keep the noise level at desired level. If this duct is replaced by a rectangular duct of aspect ratio of 1.5, find the size of two ducts for equal friction methods when [8]

- i) the velocity of air in two ducts is same.
- ii) The discharge of air in two ducts is same.

b) Explain the following freezers for food preservation: [8]

Blast freezer, IQF, Plate Freezer & Spiral freezer

OR

Q12)a) Explain equal friction method of duct design with suitable example. [8]

b) Explain various dynamic losses in ducts. How these losses are calculated? [8]



