

22660

23124

3 Hours / 70 Marks

Seat No.

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- Instructions :**
- (1) All Questions are *compulsory*.
 - (2) Illustrate your answers with neat sketches wherever necessary.
 - (3) Figures to the right indicate full marks.
 - (4) Assume suitable data, if necessary.
 - (5) Use of Non-programmable Electronic Pocket Calculator is permissible.
 - (6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.
 - (7) Use of steam tables, Psychrometric chart, Mollier's chart is permitted.

Marks

1. Attempt any FIVE of the following :

10

- (a) Define one ton of refrigeration.
- (b) List the factors that affect human comfort.
- (c) List any four manufacturers of household refrigerator.
- (d) State the function of 'Drier'.
- (e) State any two industrial air-conditioning applications.
- (f) Define dry bulb and wet bulb temperature.
- (g) State the purpose of insulation in refrigeration and air-conditioning.



- 2. Attempt any THREE of the following :** **12**
- (a) Represent Bell Coleman refrigeration cycle on P-V and T-S diagram.
 - (b) Identify any four desirable properties of the refrigerant to be used in household refrigerator.
 - (c) Summarize the advantages of hermetically sealed compressor.
 - (d) Represent the following processes on psychrometric chart :
 - (i) Cooling with dehumidification
 - (ii) Sensible cooling
- 3. Attempt any THREE of the following :** **12**
- (a) Draw a schematic sketch of 'Air Refrigeration System' for aircraft cooling and label all the components.
 - (b) Explain the concept of 'Green House Effect' and 'Global Warming'.
 - (c) Summarize the different latent heat gain sources to be considered for calculating cooling load.
 - (d) An inventor claims to have developed a refrigerator having COP 5 while working between temperature limits of $-15\text{ }^{\circ}\text{C}$ and $50\text{ }^{\circ}\text{C}$. Check whether his claim is correct or not with proper justification.
- 4. Attempt any THREE of the following :** **12**
- (a) Air is dehumidified from an initial condition of $32\text{ }^{\circ}\text{C}$ DBT and 80% RH (Relative Humidity) to $25\text{ }^{\circ}\text{C}$ DBT and $15\text{ }^{\circ}\text{C}$ WBT. Find :
 - (i) moisture removed
 - (ii) decrease in enthalpy/kg of dry airShow the process on psychrometric chart with values.
 - (b) Describe 'Grills' and 'Resistors' and state any two functions of it.
 - (c) Illustrate with neat sketch the 'Loop Perimeter Duct System' and state its application.
 - (d) Draw a neat labelled sketch of 'evaporative condenser'. State its application.
 - (e) Illustrate with neat sketch working of revolving wick type humidifier.

5. Attempt any TWO of the following :**12**

(a) A R134a system is working at an evaporating temperature of $-10\text{ }^{\circ}\text{C}$ and the condensing temperature of $40\text{ }^{\circ}\text{C}$. Assuming that the system works on simple VCR cycle, find the following :

(i) The refrigerating effect per kg of refrigerant.

(ii) The mass of refrigerant circulated per second for 3 TR capacity unit.

Take, enthalpy of saturated vapour at $-10\text{ }^{\circ}\text{C} = 399.28\text{ kJ/kg}$ and enthalpy of saturated liquid at $40\text{ }^{\circ}\text{C} = 256.35\text{ kJ/kg}$.

(b) Illustrate with neat sketch, the working of 'Thermostatic Expansion Valve'.

(c) R-12 refrigeration system works on vapour compression cycle. The refrigerant is subcooled by $5\text{ }^{\circ}\text{C}$ before entering expansion device. Show the cycle on P-H chart and calculate,

(i) COP

(ii) Power required to drive the compressor for one ton refrigeration capacity.

R-12 has following properties :

Enthalpy at compressor inlet = 137 kJ/kg .

Enthalpy at compressor discharge = 142 kJ/kg .

Enthalpy of saturated liquid in condenser = 1.12 kJ/kg .

6. Attempt any TWO of the following :**12**

(a) Compare vapour compression refrigeration system with vapour absorption refrigeration system on the basis of following criteria :

(i) vibration and noise

(ii) fuel or energy used

(iii) COP

(iv) part load performance

(v) time taken to produce cooling effect

(vi) capacity

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- (b) Illustrate with neat sketch the working of 'Year round air-conditioning system'.
 - (c) To calculate the cooling load of a class-room, explain the various cooling loads and calculations involved.
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