22660

23124

3 Hours / 70 Marks   Seat No. ☐☐☐☐☐☐☐☐

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 °C and 50 °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 °C DBT and 80% RH (Relative Humidity) to 25 °C DBT and 15 °C WBT. Find :

        (i)   moisture removed

        (ii)   decrease in enthalpy/kg of dry air

        Show 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 °C and the condensing temperature of 40 °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 °C = 399.28 kJ/kg and enthalpy of saturated liquid at 40 °C = 256.35 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 °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

   (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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