# 22660

**12425**

**3 Hours / 70 Marks**

Seat No.

**Instructions :**
(1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

(8) Use of steam tables, logarithmic, Mollier's chart is permitted.

**Marks**

1. **Attempt any FIVE of the following :**  **5 × 2 = 10**

(a) Represent Reversed Carnot cycle on P-V diagram.

(b) List different sensible heat load on Air-conditioned room.

(c) Explain Green House Effect.

(d) Classify condensers used in refrigeration system.

(e) List any two applications of comfort air-conditioning.

(f) Represent heating with humidification process on psychrometric chart.

(g) Name different components of Automobile Air Conditioning System.

2. **Attempt any THREE of the following :** **3 × 4 = 12**

   (a) Draw neat labelled schematic diagram of simple air-craft cooling system.

   (b) Represent vapour compression cycle on P-H and T-S diagram, if refrigerant is wet at the inlet to the compressor and dry outlet.

   (c) Explain in brief the working of Thermostatic switch with neat sketch.

   (d) Classify Dehumidifiers. Explain the working of any one dehumidifier with neat sketch.

3. **Attempt any THREE of the following :** **3 × 4 = 12**

   (a) Represent Bell Coleman cycle on P-V and T-S diagrams.

   (b) Differentiate between vapour compression and vapour absorption refrigeration system.

   (c) Enlist the factors affecting on Human Comfort.

   (d) Convert following :

       (i) 5000 Watt into TR

       (ii) 10.7 TR into kW

4. **Attempt any THREE of the following :** **3 × 4 = 12**

   (a) Represent following processes on psychrometric chart :

       (i) Cooling with dehumidification

       (ii) Heating with dehumidification

   (b) Name four types of insulating materials used in refrigeration and air conditioning with one example of each type.

   (c) Draw labelled layout of direct central air conditioning system mentioning all the components.

(d) Explain construction of flooded type evaporator with neat sketch.

(e) With the help of psychrometric chart, find Dew point temperature and Wet bulb temperature of air at 28 ºC DBT and 70% Relative Humidity. Represent condition on psychrometric chart.

5. **Attempt any TWO of the following :**                    $2 \times 6 = 12$

(a) A vapour compression refrigerator uses R12 as a refrigerant and the liquid evaporates in the evaporator at –15 ºC. The temperature of this refrigerant at the delivery from the compressor is 15 ºC. When the vapour is condensed at 10 ºC, find the coefficient of performance if (A) There is no undercooling (B) The liquid is cooled by 5 ºC before expansion by throttling. Taking $C_p$ for superheated vapour = 0.64 kJ/kg.

$C_p$ for liquid as 0.94 kJ/kg

The other properties of refrigerant are as follows :

| Temp. in ºC | Enthalpy kJ/kg | | Specific Entropy in kJ/kg ºK | |
|:---:|:---:|:---:|:---:|:---:|
| | hf liquid | hg vapour | sf liquid | sg vapour |
| –15 | 22.3 | 180.88 | 0.0904 | 0.7051 |
| 10 | 45.4 | 191.76 | 0.1750 | 0.6921 |

Represent on P-H and T-S diagram.

(b) Explain construction of Scroll Compressor with neat sketch.

(c) Draw layout of Aqua-Ammonia vapour absorption system. Explain its working in brief.

**6.** **Attempt any TWO of the following :** **2 × 6 = 12**

(a) A simple saturated vapour compression refrigeration cycle with the following data works on Freon 12 refrigerant :

Evaporator temperature = –20 ºC

Condensate temperature = 30 ºC

The refrigerant entering the compressor is dry saturated. Take $C_p$ for Freon 12 in superheated region = 0.165 kJ/kg ºK. Sketch P-H and T-S diagrams and calculate :

(i) COP

(ii) Weight of the refrigerant for 1 ton capacity.

(iii) Compressor power required.

Properties of Freon 12 are as follows :

| Temp. in ºC | Enthalpy kJ/kg | | Entropy kJ/kg ºK | |
|:---:|:---:|:---:|:---:|:---:|
| | **Liquid** | **Vapour** | **Liquid** | **Vapour** |
| 30 | 228.54 | 363.56 | 1.0979 | 1.543 |
| –20 | 181.76 | 342.6 | 0.931 | 1.566 |

(b) Explain with neat sketch the construction of window air conditioner.

(c) Calculate heat load of Metrology and Quality control laboratory of your institute. Suggest capacity and type of air conditioner required for the laboratory.

_____