17612

15162
3 Hours / 100 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)   Psychrometry chart is allowed.

Marks

1.   **Attempt any FIVE :**   20

(a)   Give important properties of an insulating material.

(b)   Differentiate between refrigerator and heat pump.

(c)   Plot Reverse Carnot cycle on P-V and T-S diagram. Mention all the processes involved in the cycle.

(d)   Give classification of 'Refrigerants'.

(e)   1.5 kW per ton of refrigeration is required to maintain the temperature of – 40 °C in refrigeration system, which works on Reverse Carnot cycle. Find out (i) COP (ii) Temp. of source and (iii) Heat rejected per ton.

(f)   What is the function of an 'Expansion Device' ? Which type of expansion device is used in all domestic refrigerator ?

P.T.O.

2. **Attempt any FOUR of the following :** 16

    (a) Define :

        (i) Dalton's Partial Pressure law

        (ii) Relative Humidity

    (b) Explain working of 'Vortex tube' with a neat sketch. Give its applications.

    (c) Explain the term 'By-pass factor' of heating coil and cooling coil.

    (d) Explain the term 'Effective temperature'. On which parameters does it depend ?

    (e) Draw labelled lay-out of 'Central air-conditioning' system.

3. **Attempt any FOUR of the following :** 16

    (a) Explain working of 'Flooded type evaporator' with a neat sketch.

    (b) Differentiate 'Open type' and 'Hermetically sealed type' compressors.

    (c) Classify ducts used in air-conditioning systems.

    (d) Write four industrial applications of refrigeration and A/C system.

    (e) Explain automobile air-conditioning systems.

4. **Attempt any TWO of the following :** 16

    (a) A vapour compression system uses CO_2 as refrigerant and works between the temperature limits of 25 °C and –5 °C. The dryness fraction before compression is 0.6 and compression end in the wet region. Find out COP of the system, assuming there is no sub-cooling of liquid refrigerant. Use following table as properties of CO_2.

Temp. °C	Enthalpy kJ/Kg		Entropy kJ/Kg. °K		Latent Heat kJ/Kg
	Liquid	Vapour	Liquid	Vapour	
25	164.77	282.23	0.5978	0.9918	117.46
–5	72.57	321.33	0.2862	1.2146	248.76

    (b)   Explain working of Lithium Bromide Absorption refrigeration system, with a neat sketch (block diagram).

    (c)   Explain working of 'Simple air cooling' system used for aircrafts; with a neat sketch (block diagram). Plot the cycle on T-S diagram and find out its COP.

5.   **Attempt any TWO of the following :**   **16**

    (a)   Enlist various types of heat loads to be considered while designing air-conditioning system for a particular room/lab. How 'room sensible heat factor' is calculated ?

    (b)   A surrounding air having DBT 38 °C and RH 60% is converted to conditioned air having DBT 26 °C and WBT 24 °C. Plot the process on psychrometry chart and find out following properties of conditioned air :

        (1)   RH

        (2)   Specific humidity

        (3)   Enthalpy

        (4)   Specific volume

        (5)   By-pass factor of cooling coil

        (6)   Apparatus dew point temperature

    (c)   Represent a neat labelled T-S & P-H diagram for the following :

        (i)   Wet refrigerant at the end of compression

        (ii)   Dry and saturated refrigerant at the end of compression, also write C.O.P. equations for the both conditions.

6. **Attempt any FOUR :** **16**

   (a)   Explain working of 'Thermostatic Expansion Valve' with a neat sketch.

   (b)   Differentiate between 'air cooled' and 'water cooled' condensers.

   (c)   Explain working of 'year round air-conditioning'.

   (d)   Differentiate between 'Central' and 'Unitary' air-conditioning systems.

   (e)   Explain any one Humidifier with a neat sketch.

   (f)   Enlist different types of fans used in air-conditioning system. Explain any one with a sketch.

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