



22660

12223

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) Use Psychrometry chart.

**Marks**

1. Attempt any FIVE :

10

- (a) Give unit of Refrigeration and define it.
- (b) Give any two excellent properties of  $\text{NH}_3$ , used as refrigerant.
- (c) List out parameters controlled in 'air-conditioning' systems.
- (d) A refrigerator works on reversed Carnot cycle between the temperature limits of  $-5^\circ\text{C}$  and  $35^\circ\text{C}$ . Find out its COP.
- (e) Give classification of ducts.
- (f) Enlist advantages of Hermetically sealed compressor over open type compressor.
- (g) On p-H and T-S diagram show vapour compression cycle started compression with wet inlet and dry outlet.



**2. Attempt any THREE :****12**

- (a) Plot 'reversed Carnot cycle' on P-V and T-S diagram. Also mention processes involved in the cycle.
- (b) Explain effect of 'Superheating' on COP with the help of p-H diagram.
- (c) Give important desirable properties of an 'Ideal refrigerant'.
- (d) For 'storage tank type water cooler' suggest –
  - (i) Compressor
  - (ii) Condenser
  - (iii) Expansion device
  - (iv) Evaporator
  - (v) Refrigerant.

**3. Attempt any THREE :****12**

- (a) Enlist factors affecting human comfort.
- (b) Explain working of 'Flooded type evaporator' with a neat sketch.
- (c) Enlist pressure losses occurred in the duct.
- (d) Explain working of 'Thermostatic Expansion Device' with a neat sketch.
- (e) A dense air machine operates on reversed Brayton cycle, & having capacity 10 TR. Its pressure limits are 1.4 bar and 4.2 bar. The air cooled in cooler at a temperature of 50 °C and temp of air at inlet to compressor is –20 °C. Determine – (i) COP of the cycle (ii) Mass of air circulated per minute.

**4. Attempt any THREE :****12**

- (a) Explain 'frosting of evaporator'. On this basis classify evaporators.
- (b) Show 'sensible heating' process on the psychrometric chart. Find out 'by-pass factor' of heating coil.
- (c) Enlist insulating materials used in refrigeration field.
- (d) Explain working of 'Vapour Compression cycle' with block diagram. plot it on p-H and T-S diagram.

**5. Attempt any TWO :****12**

- (a) The temperature limits of an ammonia refrigerating system are 25 °C and –10 °C. If the gas is dry at the end of compression. Calculate COP of the system, assuming there is no sub-cooling of liquid refrigerant.

Use following table as properties of NH<sub>3</sub>.

Temp °C	Liquid Heat (kJ/kg)	Latent Heat (kJ/kg)	Liquid Entropy (kJ/kg °k)
–10	133.37	1297.68	0.5443
25	298.9	1166.94	1.1242

- (b) A surrounding air having DBT = 38 °C and 25 gm/kg of DA humidity ratio is converted to conditioned air having DBT = 26 °C and RH = 50%. Plot the process on psychrometric chart and find out all other properties of conditioned air.
- (c) List of various types of heat loads to be considered while designing air-conditioning system.

**6. Attempt any TWO :****12**

- (a) Explain ‘Air Refrigeration System’ used for aircraft with block diagram. Also represent it on T-S diagram and find out its COP.
- (b) Only draw ‘Simple Vapour Absorption System’ with block diagram. How it is converted to ‘Practical Vapour Absorption System’.
- (c) Design the layout of ‘Summer air-conditioning system’ for Delhi city.
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