

Total No. of Questions : 10]

SEAT No. :

P2222

[Total No. of Pages : 6

[5254]-555

**B.E. (Mechanical Sandwich)**  
**REFRIGERATION & AIR CONDITIONING**  
**(2012 Pattern)**

*Time : 2 ½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Neat diagram must be drawn wherever necessary.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of logarithmic tables slide rule, Mollier charts, Electronic pocket calculator, Steam tables and p-h chart is allowed.*
- 4) *Assume suitable data, if necessary.*

**Q1) a)** Explain the effect of following on COP of vapour compression refrigeration system with schematic Ph diagram- [4]

- i) Condensing temperature
- ii) Suction gas superheat in the suction pipe line

**b)** A refrigerator working on Carnot cycle has refrigerating COP of 5. [6]

- i) Determine the ratio of  $T_1/T_2$
- ii) If the work done is 5 kW, determine the maximum refrigeration effect in TR.
- iii) If this cycle is used as heat pump, determine the COP and heat delivered.

OR

**Q2) a)** Why COP of Bell Coleman cycle is lower than Carnot cycle? Explain with the help of T-s diagram. [4]

**b)** A Bell-Coleman refrigerator of 5 TR capacity operates between 1 bar & 6 bar. Air temperature at the inlet of compressor and expander are 15° C and 35°C respectively. Both compression and expansion indices are 1.2. Find- [6]

*P.T.O*

- i) Mass of air circulation per minute.
- ii) Power required.
- iii) COP

**Q3) a) What are Zeotropes and Azeotropes? How they are designated? [4]**

b) A vapour compression refrigeration system working on R 134a operates between  $-10^{\circ}\text{C}$  and  $38^{\circ}\text{C}$ . The liquid refrigerant is sub cooled to  $32^{\circ}\text{C}$ . The vapour leaving evaporator is dry saturated. Assuming isentropic compression calculate: [6]

- i) Refrigeration effect in kJ/kg.
- ii) Work of Compression in kJ/kg
- iii) COP

Properties of ammonia R 134a

Temperature °C	Specific Enthalpy kJ/kg		Specific Entropy kJ/kgk		Specific Heat kJ/KgK	
	Liquid	Vapour	Liquid	Vapour	Liquid	Vapour
-10	186.70	392.66	0.9506	1.7334	1.316	0.854
32	244.62	415.78	1.1529	1.7138	1.4561	1.080
38	253.43	418.55	1.1811	1.7118	1.4871	1.127

OR

**Q4) a) List down the desirable properties of Refrigerant-Absorbent combination used in vapour absorption refrigeration system. [6]**

b) Explain cascade system with simple schematic arrangement diagram.[4]

**Q5) a) In a cooling application, moist air enters a refrigeration coil at a rate of 100 kg da/min at  $35^{\circ}\text{C}$  DBT and  $25^{\circ}\text{C}$  WBT. The ADP of the coil is  $15^{\circ}\text{C}$  and bypass factor is 0.2 Determine: [8]**

- i) Outlet state of the moist air (DBT & W)
  - ii) Rate of water removal from the air kg/min
  - iii) SHF of the process
  - iv) Refrigeration capacity in TR
- b) For determining cooling capacity of air conditioning system for an office, what different factors are to be considered? How dehumidified air quantity is calculated? [6]
- c) Define- [4]
- i) Degree of saturation
  - ii) Relative humidity

OR

- Q6)** a) Obtain the following properties of moist air at 30° C DBT and 25° C WBT without using psychrometric chart. [8]
- i) Partial pressure of water vapour
  - ii) RH
  - iii) Specific humidity
  - iv) Air density
  - v) Vapour density
  - vi) Enthalpy of moist air
- Assume barometric pressure 1.01325 bar.
- Steam properties - Psat at 30°C: 0.00425 MPa and Psat at 25°C: 0.00317 MPa
- b) What are the six primary factors affecting thermal comfort? Explain ASHRAE comfort zone. [6]

- c) Explain following terms: [4]
- i) Humidity ratio
  - ii) Wet bulb temperature

- Q7)** a) Explain Variable Refrigerant Volume systems with neat sketch. What are the advantages of VRVs over a central air conditioning plant. [8]
- b) What are the different ways of classifying refrigeration compressors? Explain any one type with neat sketch. [8]

OR

- Q8)** a) What different type of expansion devices are used in refrigeration system? Explain working of Thermostatic Expansion Valve with neat sketch. What are the advantages of Thermostatic expansion valve. [8]
- b) Explain working of screw compressor with neat sketch. [4]
- c) Compare VAV with fixed air volume system. [4]
- Q9)** a) What are the different ways of classifying ducts? [4]
- b) What materials are commonly used for duct fabrication? What are the IS standards for guage of GI sheets? [4]
- c) What are the different types of pressure losses in duct systems? [4]
- d) List different types of fans used in AHU. Why forward curved blowers are preferred for domestic and commercial air conditioning applications. [4]

OR

**Q10)** a) Derive equation for circular equivalence of rectangular duct for the two alternatives- [8]

i) Velocity of air in both the ducts should be maintained

ii) Quantity of air flowing through both the ducts should be same.

b) What is the empirical relation used for determining frictional pressure loss in GI ducts? Write a short note on duct friction chart. [8]



