Total No. of Questions : 10]

SEAT No. :

P3584

[Total No. of Pages : 5

[4959]-1054

B.E. (Mechanical Sandwich) (End Semester)

REFRIGERATION AND AIR CONDITIONING

(2012 Pattern) (Elective - I(a))

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary and mention it clearly.***
5) ***Use of steam table is allowed.***

Q1) a) Explain the basic components of a typical automobile air conditioning system. **[5]**

b) A refrigeration system operating on R-134a refrigerant includes liquid to vapour heat exchanger. The heat exchanger cools saturated liquid coming out of condenser from 32ºC to 22ºC with the help of vapour coming out of evaporator at -12ºC saturated. The compression is isentropic. Draw the cycle of p-h diagram and using p-h diagram determine **[5]**

i) COP of the system

ii) COP of the system without liquid to vapour heat exchanger

OR

Q2) a) Explain the actual VCC with the help of T-s and P-h diagrams. **[5]**

b) With neat diagram explain Cascade refrigeration system. **[5]**

Q3) a) What are zeotropic and azeotrope refrigerants? Explain their advantages with example. **[5]**

b) A Bell-Coleman cycle works between 17 bar and 3.4 bar. The temperature of air after the cooler is 15ºC and after the refrigerator is 6ºC. For refrigeration capacity of 6TR determine :

P.T.O.

i) Temperature after compression and expansion

ii) Air circulation required per minute

iii) Theoretical COP

Take C_P = 1.005 kJ/kgK and C_V= 0.718 kJ/kgK **[5]**

OR

Q4) a) List the desirable properties of refrigerant -absorbent pair in vapour absorption refrigeration system. **[4]**

b) A R-134a refrigeration system involves two evaporators, E1 operating at -10ºC, and E2 at +10ºC respectively. The refrigeration capacities of E1 and E2 are 10 TR and 20 TR respectively. The system uses individual compressors and individual expansion valves. The refrigerant temperature at outlet of condenser is 30ºC saturated. Draw the schematic diagram of refrigeration system and plot the cycle on P-h diagram. **[6]**

Determine COP of the system if vapour are fully saturated at compressor inlet.

Q5) a) Explain the followings : **[8]**

Relative humidity,

Dew point temperature,

Wet bulb temperature,

Thermodynamic wet bulb temperature

b) Air at 38ºC and 25% RH passes through an evaporative cooler. If air leaving temperature is 25ºC, how much water is added per kg dry air and what is the final relative humidity?

If relative humidity is to be maintained 55%, what should be the air leaving temperature? **[8]**

OR

Q6) a) What is an effective temperature? Explain the factors which govern optimum effective temperature. **[8]**

b) What do you mean by infiltration air and ventilation air? Discuss the methods to calculate infiltration air. **[8]**

Q7) a) With neat diagram explain the working of flooded evaporator. what are the advantages of flooded evaporator over DX evaporator? **[8]**

b) Explain VRF systems with neat diagram. **[8]**

OR

Q8) a) Explain VAV air conditioning system. Discuss its advantages and limitations. **[7]**

b) Classify the refrigerant compressors. What is the selection criteria of refrigerant compressors? Explain with example. **[9]**

Q9) a) With neat diagram explain constructional details and working of air handling unit. **[8]**

b) A duct AB, 1.5 m × 1m in size, carrying conditioned air runs 50 m from the fan outlet. Then it divides into two parts BC and BD each of 80 m in length and 1.5 m × 1m in cross section. If the air discharge at the outlet of BC is 1600 cmm, determine the quantity discharged at the point BD and fan static pressure.

Calculate duct friction loss using, $\Delta P_f = \frac{4fL}{D}\left(\frac{V^2}{1.66}\right)$

Where D & L are equivalent diameter and length of duct in m, V is velocity in m/s. Take f = 0.005. **[10]**

OR

Q10) a) Explain static regain method of duct design with suitable example. **[10]**

b) Explain fan laws. Give selection criteria of fan for air conditioning application. **[8]**