M.Tech (with Credits)-Regular-Semester 2012-Heat Power Engineering Sem II

MT-1017 - Advanced Refrigeration & Air Conditioning

P. Pages : 2 **GUG/W/16/3961**

Time : Three Hours * 4 6 2 8 * Max. Marks : 70

Notes :
1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.
5. Use of slide rule, logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.
6. Answer **any five** questions.

1. a) Explain various pressure losses in actual VCRS system with p-h & T-S diagram. **6**

b) A R-12 refrigerating machine working on vapour compression cycle receives saturated vapour at 5^oC at the entry to compressor. It is compressed isentropically. Refrigerant is condensed at 40^oC . Determine : $\rightarrow$ **8**

i) Coefficient of performance [COP]
ii) Power per ton of refrigeration
iii) Theoretical piston displacement per ton of Refrigerant

Use following properties of refrigerant :
Enthalpy of refrigerant at compressor Inlet = 189.7 kJ/kg
Sp. Volume of refrigerant at compressor Inlet = 0.049 m^3/kg
Enthalpy of refrigerant at compressor Exit = 203.2 kJ/kg
Enthalpy of refrigerant at condenser Exit = 74.6 kJ/kg
Represent the cycle on p-h & T-S diagram.

2. a) In an Aqua-Ammonia refrigerant absorption system of 9 tonnes refrigeration capacity. The vapours leaving the generator are 100% pure NH_3, saturated at 40^oC. The evaporator, absorber, condenser & generator temperatures are -20^oC, 30^oC, 40^oC & 70^oC respectively. At the absorber exit (strong solution) the concentration of Ammonia in solution is (x-0.38) & the enthalpy is (h = 22 kJ/kg). At the generator exit (weak solution) concentration is (x = 0.1) & enthalpy is (h = 695 kJ/kg). **10**

Calculate : $\rightarrow$

i) The mass flow rate of Ammonia in evaporator.
ii) Carry out overall mass conservation & mass conservation of ammonia in absorber to determine the mass flow rates of weak & strong solution.
iii) Heat rejection in absorber & condenser.
iv) Heat added in generator.
v) COP.

b) Give classification of refrigerants & explain desirable properties of an ideal refrigerant. **4**

3. a) Explain ozone layer depletion & its effects also explain global warming. **7**

b) Draw neat sketches of claude system & linde system & also mention advantages of claude system over linde system. **7**

4. a) Explain with the help of neat sketch domestic Electrolux (Ammonia Hydrogen) Refrigerator. **7**

b) Discuss pulse tube refrigeration system with the help of neat sketch. **7**

5. a) A Thermodynamic refrigeration system consists of N-pairs, connected in series. It works under 6-volt solar battery. The hot & cold junctions are maintained at 40^oC & 10^oC respectively. The properties of thermodynamic materials are $\alpha_p = 0.00016\ v/k$ & $\alpha_n = -0.0002\ v/k$. The resistance & conductance for each pair are $0.003\Omega(ohm)$ & 0.02 w/k respectively. **10**

Determine : for the cases.

i) for max^m COP.

ii) for max^m cooling, the following

a) No. of thermoelectric couples,

b) Tonnage (cooling) of the unit,

c) Power consumed &

d) Compare the COP with carnot value.

b) Discuss in detail Montreal & Kyoto protocols ? **4**

6. a) Explain the utility of following simulation softwares in refrigeration. **6**

i) Evap - cond

ii) POREZ

b) Describe various air distribution devices with neat sketches. **8**

7. a) Explain with the help of neat sketches various losses in ducts & also mention selection of duct. **7**

b) Discuss in detail Retrofitting of domestic refrigerators. **7**

8. Write short notes **any three.** **14**

i) Factors considered for heat load calculation.

ii) Duct design & classify it.

iii) Equipment selection for air conditioning purpose.

iv) Eco-Friendly refrigerants.

v) Concept of green house effect.

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