Diploma in Electrical and Mechanical Engineering

00159

Term-End Examination

June, 2011

BME-043 : RAC/UTILIZATION

Time : 2 hours *Maximum Marks : 70*

Note : *All questions are* ***compulsory.*** *Use of calculator is allowed. Psychrometric chart is provided.*

1. Choose the correct answer. **14x1=14**

(a) The main difference between a refrigerating machine and a heat pump is in their :

(i) Operating pressure

(ii) Operating temperature

(iii) Net volume

(iv) None of the above

(b) Which one of the following is the designation of R f 17 ?

(i) Carbon dioxide

(ii) Water

(iii) Ammonia

(iv) Methane

(c) In a simple vapour compression refrigeration system the receiver supplies refrigerant to the :

(i) Compressor (ii) Condenser

(iii) Expansion valve (iv) Evaporator

(d) The density of the refrigerant should be :

(i) as small as possible

(ii) as large as possible

(iii) medium

(iv) None of the above

(e) In counterflow heat exchanger, the direction of flow of hot and cold fluid is :

(i) Same (ii) Opposite

(iii) At 90°C (iv) None

(f) If H_1, H_2, H_3 and H_4 are the enthalpy of refrigerant at the end of evaporation, compression, condensation and expansion respectively, what should be the work done ?

(i) $H_2 - H_1$ (ii) $H_1 - H_4$

(iii) $H_3 - H_4$ (iv) $H_2 - H_3$

(g) Viscosity of refrigerant should be :

(i) High (ii) Medium

(iii) Low (iv) Nothing can be said

(h) Which one is the correct expression of effectiveness for parallel flow heat exchanger ?

(i) $\frac{1-e^{-NTU(1-R)}}{1+e^{-NTU(1-R)}}$

(ii) $\frac{1+e^{-NTU(1-R)}}{1-e^{-NTU(1-R)}}$

(iii) $\frac{1-e^{-NTU(1-R)}}{1-R}$

(iv) $\frac{1-e^{-NTU(1+R)}}{1+R}$

(i) The ratio of sensible heat transfer to the total heat transfer is called as :

(i) SHF (ii) LHF

(iii) RTCL (iv) BF

(j) In cooling and humidification process.

(i) dry bulb temperature reduces and moisture content increases.

(ii) dry bulb temperature increases and moisture content decreases.

(iii) only dry bulb temperature decreases

(iv) only moisture content decreases.

(k) In the equation $Q = UA \Delta Tm$, the term Tm is :

(i) Base temperature

(ii) Log mean temperature

(iii) Wet bulb temperature

(iv) Medium temperature

(l) $Wm^{-1} K^{-1}$ is the unit of :

(i) Thermal conductivity

(ii) Thermal resistance

(iii) Heat transfer coefficient

(iv) None of the above

(m) RPM of the rotating component is measured by :

(i) Pirani (ii) Megger

(iii) Wattmeter (iv) Stroboscope

(n) As per fan law's, which is the correct one ?

(i) $Q \propto N^2$ (ii) $Q \propto N^3$

(iii) $Q \propto N$ (iv) $Q \propto N^5$

2. Answer the following :

(a) (i) Define coefficient of performance of refrigeration cycle. **3+4**

(ii) Describe vapour compression refrigeration system, stating major components.

OR

State all processes involved in vapour compression refrigeration indicating on T-s and P-h diagram. 7

(b) Write any five thermodynamic properties of a good refrigerant. Can water be used as a refrigerant ? 7

3. Answer *any two* of the following : 2+5

(a) (i) State the law of cooling for convention

(ii) Deduce an expression for overall heat transfer coefficient for a plane composite wall.

(b) (i) What is a heat exchanger ? How are the heat exchangers classified ? 3+3+1

(ii) Describe any one type of heat exchanger.

(iii) Expand the term LMTD.

(c) (i) State different types of heat transfer modes in evaporators. 3+3+1

(ii) What are the common methods of augmentation of heat transfer in evaporators ?

(iii) Define recirculation number '*n*'.

4. Answer ***any two*** of following :

(a) (i) How are compressors classified ? **2+2+3**

(ii) Define volumetric efficiency.

(iii) Write methods of improving volumetric efficiency.

(b) (i) What is the function of condenser in refrigeration system ? **2+5**

(ii) Write short notes on ***any two*** :

(A) Air cooled condenser

(B) Water cooled condenser

(C) Evaporative condenser

(c) (i) What is the function of evaporator in refrigeration system ? **2+5**

(ii) How are the evaporators classified ? Explain the functioning of any one type with the help of neat sketch.

5. Answer ***any two*** of the following :

(a) 100 m^3 of air per minute at 30°C DBT and 60% RH is cooled to 20°C DBT by passing through a cooling coil. Atmospheric pressure is 1 bar. Using psychrometric chart, find : **7**

(i) Capacity of cooling coil in TR

(ii) RH and WBT of air after cooling

(b) In P-h diagram as shown in fig. 1 $h_1 = 102$ kJ/kg, $h_2 = 215.6$ kJ/kg and $h_3 = h_4 = 42$ kJ/kg. **7**

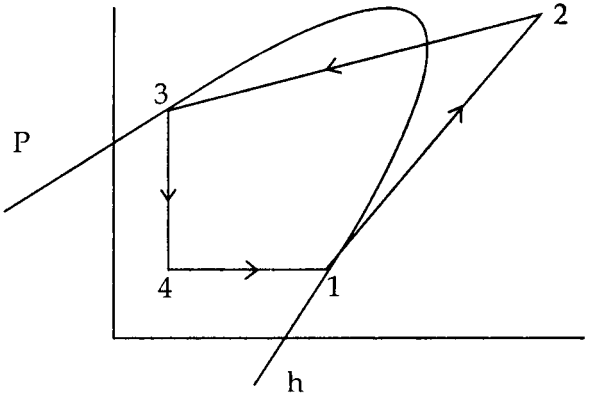

Fig. 1

Calculate :

(i) Compressor work

(ii) Heat absorbed in evaporator

(iii) Heat rejected in condenser

(iv) COP of cycle.

(c) Define bypass factor. List out the major sources of heat gain for air conditioning load estimation. **7**