FACULTY OF ENGINEERING

B.E. 3/4 (Mech.) II – Semester (New) (Main) Examination, May 2013

Subject : Refrigeration and Air Conditioning

Time : 3 hours   Max. Marks : 75

Note : Answer all questions from Part-A. Answer any FIVE questions from Part-B.

PART – A (25 Marks)

1. Ice is formed at 273 K from water at 293 K. The temperature of the brine is 265 K. Find out the kg of ice formed per kWh. Assume the refrigeration cycle is perfect reversed Carnot cycle. Take latent heat of ice is 335 k J/kg.

2. What are the desirable properties of refrigerants?

3. What are the advantages of compound refrigeration over simple vapor compression cycle?

4. Draw schematic sketch for vapor compression refrigeration system; show it on P-H chat and T-s diagram.

5. What are the advantages and limitations of steam refrigeration system?

6. Draw configuration diagram of Electrolux refrigeration system.

7. Draw psychrometric chart for summer air conditioning process.

8. Define body defense mechanism in regulating temperature of the body.

9. Write short notes on condensers.

10. How to estimate latent heat load and sensible heat load?

PART – B (50 Marks)

11. A dense air machine is to produce 35 kW of refrigeration with a compressor entrance pressure of 1.5 bar and a temperature of 0^0C. The compressor discharge pressure is 20.5 bar. The air temperature leaving he cooler is 38.5^0C. The index of compression and expansion are 1.25 and 1.35 respectively. The clearance factor of the compressor is 2%. Calculate : i) the refrigerating effect per kg of air circulated per minute. ii) the volumetric efficiency of compressor and iii) piston displacement. Assume compressor is single acting and speed of the compressor is 240 rpm.

12. The temperature limits of an ammonia refrigerating system operating on simple vapor compression cycle are 30^0C and -10^0C respectively. The vapor is 95% dry at the end of compression. Assuming the actual C.O.P. as 60% of the theoretical, calculate the ice produced in kg per kW-hour at 0^0C from water at 10^0C. Latent heat of ice is 335 kJ/kg. Use the following table for the properties of ammonia.

Temperature (^{0}C)	Liquid heat(h_f) (kJ/kg)	Latent heat (h_{fg})	Liquid entropy (s_f) (kJ/kg-K)
30	323.08	1145.80	1.2037
-10	135.37	1297.58	0.5443

13. Explain lithium-bromide refrigeration system with the help of neat sketch.

14. It is required to design an air conditioning plant for a small office for following hot and wet summer conditions : Outlet conditions : 32^0C DBT, 65% RH, required conditions : 22^0C DBT and 60%. Amount of air circulation = 250 m3/min, coil dew temperature is 15^0C. The required condition is achieved by first cooling and dehumidifying : Calculate the i) cooling capacity of cooling coil and its bypass factor, ii) Heating capacity of the heating coil and surface temperature of the heating coil if by pass factor is 0.3 and iii) The mass of water vapor removed per hour.

15.a) Explain the working principle of thermostat expansion valve and automatic expansion valve with the help of neat sketches.

   b) Write short notes on applications of refrigeration.

16. Derive an expression for COP of absorption refrigeration system in terms of Carnot COP and list out the merits and demerits of vapor absorption system over simple vapor compression system.

17. Explain any two air craft refrigeration systems with the help of configuration diagram and T-s diagram.

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