Code No. : 3082

FACULTY OF ENGINEERING

B.E. 3/4 (Mech. / Prod.) II Semester (Main) Examination, May/June 2011

REFRIGERATION AND AIR CONDITIONING

Time : 3 Hours] **[Max. Marks : 75**

Note : (1) Use of Psychrometric Charts, Refrigeration Tables, and Steam Tables is permitted.
(2) Missing data, if any, may suitably be assumed.
(3) Answers **all** questions from Part – **A**, answer any **five** questions from Part – **B**.

PART – A (Marks : 25)

1. Define the term "Tonne of refrigeration". 2

2. A Carnot refrigeration system working temperature of – 30 °C and 70 °C. What is the maximum C.O.P. possible ? If the actual C.O.P. is 75% of the maximum, calculate the actual refrigerating effect produces per kWhr. 3

3. Sketch the T – S and P – h diagrams for the vapour compression cycle when the vapour after compression is superheated and after condensation is sub-cooled. 2

4. What are the limitations of single vapour compression refrigeration systems for production of low temperature ? 3

5. Define Seebeck effect and Peltier effect. 3

6. List the advantages of vapour absorption system. 2

7. State the factors that determine human comfort. 2

8. Draw the sketch of sling psychrometer. Explain its function. 3

9. Explain how GSHF may vary as the supply air quality and supply air condition change. 3

10. List the applications of Transport air conditioning. 2

PART – B (Marks : 50)

11. A simple air refrigeration system is used for an aircraft to take a load of 20 TR. The ambient pressure and temperature are 0.9 bar and 22 °C respectively. The pressure of air is increased to 1 bar due to isentropic ramming actions. The air is further compressed in a compressor to 3.5 bar and then cooled in a heat exchanger to 72 °C. Finally, the air is passed through the cooling turbine and then it is supplied to the cabin at a pressure of 1.03 bar. The air leaves the cabin at a temperature of 25 °C. Assuming the isentropic efficiencies of the compressor and turbine as 80% and 75% respectively. Find (a) power required to take the load in the cooling cabin and (b) C.O.P. of the system. 10

Take C_P = 1.005 kJ/kg K; γ = 1.4

12. (a) Explain with p – h diagram the effect of (1) evaporating pressure and (2) condenser pressure in vapour compression system. 5

(b) Draw and explain the compound compression with "Flash Intercooler". 5

13. Draw the T – S and h – s diagrams of a steam jet refrigeration system and write the expression for 10

(a) Nozzle efficiency

(b) Entertainment efficiency

(c) Compression efficiency

14. List the various psychrometric process and indicate on the skeleton psychrometric chart and explain them. 10

15. A hall is to be maintained at 24 °C DBT and 60% RH under the following conditions : 10

Outside conditions = 38 °C DBT and 28 °C WBT sensible heat load in the room = 46.4 kW.

Latent heat load in the room = 11.6 kW

Total infiltration air = 1200 m^3/hr

Apparatus dewpoint temperature = 10 °C

Quantity of recirculated air from the hall = 60%

If the quantity of recirculated air is mixed with the conditioned air after the cooling coil, find the following :

(a) The condition of air leaving the conditioner coil and before mixing with the recirculated air;

(b) The condition of air before entering the hall

(c) The mass of air entering the cooler

(d) The mass of total air passing through the hall;

(e) The by-pass factor of the cooling coil; and

(f) The refrigeration load on the cooling coil in tonnes of refrigeration.

16. (a) Explain the advantages, limitations and applications of cryogenics. 5

(b) Explain the main factors of "Effective Temperature" and its significance in the design of air conditioning system. 5

17. (a) Explain the various thermodynamic properties of good refrigerants. 4

(b) Explain with neat sketch the working principle of Electrolux refrigerator. 6
