No. of Printed Pages : 4

BIME-015

B. Tech. – VIEP – MECHANICAL ENGINEERING (BTMEVI)

Term-End Examination

00176

June, 2015

BIME-015 : REFRIGERATION AND AIR CONDITIONING

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions. All questions carry equal marks. Use of Steam table, Refrigeration tables and charts, Mollier diagram, Psychrometic chart, and Scientific calculator is permitted.*

1. A cold storage plant is required to store 30 tonnes of fish. The temperature of the fish when supplied = 25°C, storage temperature of fish required = – 8°C, specific heat of fish above freezing point = 2·93 kJ/kg°C, specific heat of fish below freezing point = 1·25 kJ/kg°C, freezing point of fish = – 3°C. Latent heat of fish = 232 kJ/kg. If the cooling is to be achieved within 8 hours, find out :

(a) the capacity of the refrigerating plant,

(b) Carnot cycle C.O.P within this temperature range.

(c) If the actual C.O.P is $\frac{1}{3}$rd of the Carnot C.O.P, find out the power required to run the plant. *14*

2. 500 kg of atmospheric air is circulated per hour in an open type of refrigeration installation. The air is drawn from the cold chamber at temperature 8°C and pressure abs 1 bar, and then compressed isentropically to 5 bar abs. It is cooled at this pressure to 28°C and then led to the expander where it expands isentropically down to atmospheric pressure and is discharged to cold chamber.

Determine :

(a) Heat extracted from cold chamber per hour

(b) Heat rejected to cooling water per hour

(c) C.O.P. of the system. *14*

3. An ammonia ice plant operates between a condenser temperature of 35°C and an evaporator temperature of –15°C. It produces 10 tonnes of ice per day from water at 30°C to ice at – 5°C. Assume simple saturation cycle. Using only tables of properties for ammonia, determine :

(a) the capacity of the refrigeration plant,

(b) the mass flow rate of refrigerant,

(c) the discharge temperature and

(d) the theoretical and actual C.O.P. *14*

4. Calculate the following for atmospheric air when DBT is 35°C, WBT is 23°C and the barometer reads 750 mm Hg : *14*

   (a) Relative humidity

   (b) Humidity ratio

   (c) Dew point temperature

   (d) Enthalpy of the atmospheric air

5. Moist air enters a chamber at 5°C DBT and 2·5°C WBT at a rate of 90 cmm. The barometric pressure is 1·01325 bar. While passing through the chamber, the air absorbs sensible heat at the rate of 40·7 kW and picks up 40 kg/h of saturated steam at 110°C.

   Determine the dry bulb temperature and wet bulb temperature of the leaving air. Also determine the relative humidity of the leaving air. *14*

6. A retail shop located in a city at 30° N latitude has the following loads :

   Room sensible heat = 58·15 kW

   Room latent heat = 14·54 kW

   The summer outside and inside design conditions are :

   Outside : 42°C DBT, 28°C WBT

   Inside : 24°C DBT, 49% RH

72 cmm of ventilation air is used. Determine the following : *14*

(a) Ventilation load

(b) Grand total heat

(c) Effective sensible heat factor

(d) Apparatus dew point

(e) Dehumidified air quantity

(f) Condition of air entering and leaving apparatus

7. Write short notes on any ***two*** of following : *7+7*

(a) Simple vapour absorption system

(b) By-pass factor

(c) Evaporative cooling

(d) Refrigerant and its selection