No. of Printed Pages : 4

BIME-015

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

Term-End Examination

December, 2014

01345

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 charts, Mollier diagram, Psychrometic chart, and Scientific calculator is permitted.*

1. A Carnot refrigerator requires 1·5 kW per tonne of refrigeration to maintain a region at low temperature of – 38°C. Determine : *14*

(a) C.O.P. of the Carnot refrigerator

(b) Highest temperature of the cycle

(c) The heat delivered and C.O.P. when this device is used as heat pump

2. An open air cycle operated by air refrigeration system is required to produce 6 tonnes of refrigerating effect with a cooler pressure of 11 bar abs and a refrigerated space or region at a pressure of 1·05 bar. The temperature of air leaving the cooler is 38°C and the air leaving the room is 16°C. Calculate : *14*

(a) Mass of air circulated per minute

(b) Compressor displacement

(c) C.O.P.

(d) Power required per tonne of refrigeration

3. An ammonia refrigerating machine has working temperature of 35°C in condenser and –15°C in the evaporator. Assume case of dry compression. Calculate the following : *14*

(a) The theoretical piston displacement per ton of refrigeration

(b) The theoretical horse power per ton of refrigeration

(c) The coefficient of performance

4. A mixture of dry air and water vapour is at a temperature of 21°C under a total pressure of 736 mm Hg. The dew-point temperature is 15°C. Find : *14*

(a) Partial pressure of water vapour

(b) Relative humidity

(c) Specific humidity

(d) Enthalpy of air per kg of dry air

5. 39·6 cubic metre of a mixture of recirculated room air and outdoor air enters a cooling coil at 31°C DB and 18·5°C WB temperature. The effective surface temperature of the coil is 4·4°C. The surface area of the coil is such that it would give 12·5 kW of refrigeration with the given entering air state. Determine : *14*

(a) The dry and wet bulb temperature of the air leaving the coil

(b) The coil bypass factor

6. A laboratory having an unusually large latent heat gain is required to be air-conditioned. The design conditions and loads are as follows :

Summer design conditions : 42°C DBT, 27°C WBT

Inside design conditions : 27°C DBT, 50% RH

Room sensible heat : 34·9 kW

Room latent heat : 18·6 kW

The ventilation air requirement is 90 cubic metre.

Determine the following : *14*

(a) Ventilation load

(b) Room and effective sensible heat factors

(c) Supply air quantity

(d) Grand total heat

7. (a) Draw and explain the vapour compression cycle on Temperature-Entropy (T-S) diagram for the case when the vapour is dry and saturated at the end of compression.

(b) Describe the following processes :

(i) Cooling and Dehumidification

(ii) Heating and Humidification *7+7=14*
