00267

DIPLOMA IN ELECTRICAL AND MECHANICAL ENGINEERING (DEME)

Term-End Examination

June, 2011

BME-032 : REFRIGERATION & AIR-CONDITIONING

Time : 2 hours *Maximum Marks : 70*

Note : *Answer **Five** questions. Question 1 is **Compulsory**.*

1. (a) Answer following questions very briefly. **2**

(i) Draw a vapour compression refrigeration circuit representing evaporator coil, expansion valve, condenser and compressors by symbols.

(ii) Draw a psychrometric chart (W_s V_sDBT) and show constant DBT, constant WBT, constant humidity ratio and constant relative humidity lines. **2**

(iii) Write a note on window type air conditioner. **2**

(b) Choose the correct answer from four choices given. 1x8

(i) A Carnot cycle refrigerator operates between highest temperature T_1 and lowest temperature T_2, index of its performance is

(A) $\frac{T_1}{T_1 - T_2}$ (B) $\frac{T_2}{T_1 - T_2}$

(C) $\frac{T_1 + T_2}{T_1 - T_2}$ (D) $\frac{T_1 - T_2}{T_1 + T_2}$

(ii) In a vapour absorption electrolux refrigerator

h_b = heat supplied by the gas burner

h_c = heat absorbed by the evaporator

The index of performance is given by

(A) $\frac{h_b}{h_c}$ (B) $\frac{h_b - h_c}{h_c}$

(C) $\frac{h_c}{h_b}$ (D) $\frac{h_c}{h_b - h_c}$

(iii) The refrigerant in a refrigeration system will be at its highest temperature

(A) between evaporator and compressor

(B) at condenser

(C) between compressor and condenser

(D) at evaporator

(iv) In a refrigeration system the refrigerant rejects heat at

(A) evaporator

(B) expansion valve

(C) condenser

(D) compressor

(v) Air conditioning consists of

(A) cooling / heating

(B) humidifying / dehumidifying

(C) removing impurities from air

(D) all of the above.

(vi) The process of dehumidifying air means

(A) reducing specific humidity

(B) reducing relative humidity

(C) reducing specific humidity at constant DBT

(D) reducing specific humidity at constant WBT.

(vii) The specific humidity of air is

(A) the weight of water vapour per kg of dry air

(B) the weight of water vapour per m^3 of dry air

(C) the weight of water vapour per kg of wet air

(D) the weight of water vapour per m^3 of wet air.

(viii) Enthalpy of air - vapour mixture (moist air) is sensible heat

(A) of dry air and water vapour

(B) and latent heat of water vapour

(C) of dry air and that of water vapour and its latent heat

(D) of dry air and that of water vapour, latent heat of water vapour and super heat of water vapour.

2. (a) In a short note bring out importance of refrigeration in respect of human comfort and preservation of food and medicine. 9

(b) Sketch a vapour absorption refrigeration cycle and mark necessary components. 5

3. (a) Show a vapour compression refrigeration cycle with dry saturated vapour on T-S and p-h planes. 6

(b) A 200 TR ice plant operates on reversed Carnot cycle between -6 °C and 25 °C. Determine 8

(i) Mass of ice produced per hour from water at 25 °C. The latent heat of fusion for ice = 340 kJ/kg.

(ii) Power required to drive the plant.

4. (a) Differentiate between centrifugal and rotary compressors. Show their construction with simple sketches. Also state their applications. 7

(b) What role is played by expansion devices in a refrigeration system. Describe functioning of capillary tube and float valves. 7

5. (a) What are cold storage and what purpose do they serve in economy. How would you describe the effect of air velocity on freezing time ? 4

(b) 31500 kg /day of fish is to be frozen to $-32°C$ in blocks, each weighing 50 kg and measuring 120 mm in thickness. The secondary refrigerant temperature is $-40°C$. The evaporating refrigerant temperature is $-47°C$. The fish enters at 28°C. The freezing cycle time may be taken as 4 hrs. Assume 10

Sp. heat of thawed fish = 3.78 kJ/kg°C
latent heat of fusion of fish = 250 kJ/kg
Sp. heat of frozen fish = 1.65 kJ/kg°C
Calculate the number of blocks frozen per cycle and refrigeration duty of the plant for 18 hours running time.

6. (a) What is effective temperature in respect of comfort air conditioning. What effect does velocity of air has on effective temperature. Show the points of equal comfort on psychrometric chart. 6

(b) On a psychrometric chart consider a point at given DBT and WBT. At this point show directions of 8

(i) sensible cooling
(ii) sensible heating
(iii) adiabatic saturation
(iv) isothermal humidification
(v) cooling and dehumidification
(vi) chemical dehumidification.