DIPLOMA IN MECHANICAL ENGINEERING (DME) ADVANCED LEVEL CERTIFICATE COURSE IN MECHANICAL ENGINEERING (DMEVI/ACMEVI)

00404

Term-End Examination

June, 2013

BME-032 : REFRIGERATION AND AIR-CONDITIONING

Time : 2 hours *Maximum Marks : 70*

Note : *All questions are **compulsory**. All questions carry equal marks. Use of calculator is **permitted**.*

1. Choose the correct answer from the given four alternatives : 7x2=14

(a) In a vapour compression refrigeration system, a throttle valve is used in place of expander because :

(i) it considerably reduces the system weight.

(ii) it improves the COP, as the condenser is small.

(iii) the passive work in isentropic expansion of liquid is very small.

(iv) it leads to significant cost reduction

(b) During the adiabatic cooling of moist air :

(i) DBT remains constant

(ii) Specific humidity remains constant

(iii) Relative humidity remains constant

(iv) WBT remains constant

(c) A refrigerating machine working on reversed carnot cycle takes out 2 kW of heat from the system while working between temperature limits of 300 K and 200 K. COP and power consumed by the cycle will be respectively :

(i) 1 and 1 kW (ii) 1 and 2 kW

(iii) 2 and 1 kW (iv) 2 and 2 kW

(d) Vapour absorption refrigeration system works using the :

(i) ability of a substance to get easily condensed or evaporated

(ii) ability of a vapour to get compressed or expanded

(iii) affinity of a substance for another substance

(iv) absorptivity of a substance

(e) The maximum COP for the absorption cycle is given by :

(T_G = Generator Temperature,

T_C = Environment Temperature,

T_E = Refrigerated Space Temperature)

(i) $\frac{T_E (T_G - T_C)}{T_G (T_C - T_E)}$

(ii) $\frac{T_G (T_C - T_E)}{T_E (T_G - T_C)}$

(iii) $\frac{T_C (T_G - T_E)}{T_G (T_C - T_E)}$

(iv) $\frac{T_G (T_C - T_E)}{T_C (T_G - T_E)}$

(f) The desirable combination of properties for a refrigerant include :

(i) high specific heat and low specific volume

(ii) high heat transfer coefficient and low latent heat

(iii) high thermal conductivity and low freezing point

(iv) high specific heat and high boiling point

(g) The expression $0.622 \frac{p_v}{p_t - p_v}$ is used to determine :

(i) relative humidity

(ii) specific humidity

(iii) degree of saturation

(iv) partial pressure

2. Answer *any two* of the following : **7x2=14**

(a) What is the difference between 'Wet compression' and 'Dry compression' in a Vapour Compression Refrigeration system ?

(b) The co - efficient of performance of a Carnot refrigerator, when it extracts 8350 KJ/ min from a heat source, is 5. Find the power required to run the compressor.

(c) A refrigerating system operates on the reversed carnot cycle. The higher temperature of the refrigerant in the system is 35°C and the lower temperature is −15°C. The capacity is to be 12 tonnes. Neglect all losses.

Determine :

(i) Coefficient of performance

(ii) Heat rejected from the system per hour

(iii) Power required

3. Answer *any two* of the following : 2x7=14

(a) With the help of block diagram, briefly explain vapour absorption refrigeration system.

(b) The temperature in a refrigerator coil is 267 K and that in the condenser coil is 295 K. Assuming that the machine operates on the reversed Carnot cycle, calculate :

(i) $COP_{ref.}$

(ii) The refrigerating effect per kW of input work.

(iii) The heat rejected to the condenser.

(c) The capacity of the refrigerator (working on reversed Carnot cycle) is 280 tonnes when operating between - 10°C and 25°C.

Determine :

(i) Quantity of ice produced within 24 hours when water is supplied at 20°C.

(ii) Minimum power (in kW) required.

4. Answer *any two* of the following : 2x7=14

(a) Define an 'air conditioning system'. Name its basic elements.

(b) Derive the relationship between the COP of a heat pump and the COP of a refrigerator.

(c) Distinguish between summer and winter air conditioning system. Why is air motion important from point of view of human comfort ?

5. Answer *any two* of the following : 2x7=14

(a) State the factors which should be taken into consideration while selecting a system of air-conditioning.

(b) Explain the advantages of central air-conditioning system over unitary air-conditioning system.

(c) Explain the processes of sensible cooling, heating, humidification, and dehumidification.