No. of Printed Pages : 5

BIMEE-032

DIPLOMA – VIEP – MECHANICAL ENGINEERING (DMEVI)

00636

Term-End Examination

June, 2016

BIMEE-032 : REFRIGERATION SYSTEMS

Time : 2 hours *Maximum Marks : 70*

Note : *Answer any **five** questions. Question no. **1** is **compulsory**. All questions carry equal marks. Use of steam table and scientific calculator is permitted. Assume missing data suitably.*

1. Choose the correct answer from the given four alternatives : *7×2=14*

(a) If the thermal efficiency of a Carnot engine is $\frac{1}{5}$, the COP of a Carnot refrigerator is

(i) 5

(ii) 4

(iii) 6

(iv) 3

(b) The entropy of a system

(i) can never decrease

(ii) can never increase

(iii) may increase or decrease

(iv) will always remain constant

(c) A 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

(d) The thermodynamic process in expansion device of a vapour compression system is considered to be

(i) Throttling

(ii) Isothermal expansion

(iii) Reversible adiabatic expansion

(iv) None of the above

(e) The following refrigerant is considered to be ozone friendly because it does not harm the ozone layer :

(i) R-12

(ii) R-22

(iii) R-11

(iv) R-134 a

(f) Which statement is ***not*** correct ?

(i) Capillary tube is used as an expansion device in domestic refrigerators.

(ii) Reciprocating type compressors are used in small capacity refrigeration systems.

(iii) Electrical power is mainly used to run vapour absorption systems.

(iv) Electrical power is used to run vapour compression systems.

(g) In milk chilling plants, the usual secondary refrigerant is

(i) ammonia solution

(ii) sodium silicate

(iii) glycol

(iv) brine

2. (a) What is refrigerating effect ? Define one tonne of refrigeration.

(b) Describe the vapour absorption refrigeration system with the help of a block diagram. 7+7

3. (a) State the merits and demerits of an air refrigeration system.

(b) A cold storage is to be maintained at – 5°C while the surroundings are at 35°C. The heat leakage from the surroundings into the cold storage is estimated to be 29 kW. The actual COP of the refrigeration plant used is one-third that of an ideal plant working between the same temperature. Find the power required (in kW) to drive the plant. 7+7

4. A Carnot refrigerator requires 1·3 kW per tonne of refrigeration to maintain a region at a low temperature of – 38°C.

Determine : *14*

(a) The COP of the Carnot refrigerator.

(b) Higher temperature of the cycle.

(c) The heat delivered and the COP when this device is used as a heat pump.

5. The capacity of a refrigerator (working on reversed Carnot cycle) is 280 tonnes when operating between – 10°C and 25°C.

Determine :

(a) The quantity of ice produced within 24 hours when water is supplied at 20°C.

(b) Minimum power (in kW) required.

Take latent heat of ice as 335 kJ/kg. *14*

6. (a) Explain Bell-Coleman cycle with the help of a neat diagram.

(b) A reversed cycle has a refrigerating COP of 4.

(i) Determine the ratio $\frac{T_1}{T_2}$; and

(ii) If this cycle is used as a heat pump, determine the COP. *7+7*

7. 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

(a) the COP of the refrigerator,

(b) the refrigerating effect per kW of input work, and

(c) the heat rejected to the condenser. *14*

8. Write short notes on any ***two*** of the following : *2×7=14*

(a) Steam Jet Refrigeration System

(b) Effect of sub-cooling of liquid on the performance of Vapour Compression System

(c) Transport Refrigeration