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

00625

Term-End Examination

December, 2014

BME-032 : REFRIGERATION AND AIR-CONDITIONING

Time : 2 hours *Maximum Marks : 70*

Note : *Answer **five** questions in all. Question no. **1** is **compulsory**. Use of scientific calculator is permitted. Use of refrigerant charts and tables is permitted.*

1. (a) Answer the following questions in brief :

(i) Draw reversed Carnot cycle on p-V and T-s diagrams and indicate the name of all processes. 2

(ii) Write the designation of the following refrigerants : 2

(A) $CHClF_2$

(B) CCl_2F_2

(C) CCl_3F

(D) $C_2H_2F_4$

(iii) Give the definitions of the following : 2

(A) Refrigeration

(B) 1 ton of refrigeration

(b) Choose the most appropriate choice in the following objective questions : $8 \times 1 = 8$

(i) Wet compression is not desirable in a vapour compression system

(A) because it decreases COP.

(B) to prevent liquid refrigerant entering the compressor.

(C) to avoid flooding of evaporator.

(D) because it increases compressor work.

(ii) A Carnot heat pump supplies heat at 30°C and absorbs heat at – 10°C. It consumes 1 kW power. It will supply heat at a rate of

(A) 6·575 kW

(B) 0·75 kW

(C) 7·575 kW

(D) None of the above

(iii) If condenser pressure increases in a vapour compression system,

(A) the COP will increase.

(B) the COP will remain same.

(C) the COP will decrease.

(D) the COP may increase, decrease or remain same.

(iv) In a vapour compression cycle, the compression process is

(A) Reversible isothermal process

(B) Reversible polytropic process

(C) Irreversible adiabatic process

(D) Reversible adiabatic process

(v) In adiabatic saturation process

(A) Specific humidity remains constant

(B) Wet bulb temperature remains constant

(C) Dry bulb temperature remains constant

(D) Relative humidity remains constant

(vi) Which is the process for summer air-conditioning ?

(A) Cooling and dehumidification

(B) Cooling and humidification

(C) Sensible cooling

(D) Cooling along constant WBT line

(vii) In which process of vapour compression cycle entropy decreases ?

(A) Reversible adiabatic compression

(B) Throttling

(C) Evaporation

(D) Condensation process

(viii) Which type of condenser is used in window air-conditioners and domestic refrigerators ?

(A) Water-cooled condenser

(B) Evaporative condenser

(C) Air-cooled condenser

(D) Barometric condenser

2. (a) Draw a simple vapour compression system and explain its working by clearly describing the function of each of its components. *8*

(b) Define the term Subcooling. What is the effect of subcooling on compressor work, refrigerating effect and COP ? What are the practical difficulties in achieving subcooling in a refrigeration system ? *6*

3. (a) Give a neat sketch of different elements of a centrifugal compressor and describe the function of each. *5*

(b) What functions are fulfilled by a capillary tube in a refrigeration system ? How does it work ? *5*

(c) What is the function of an evaporator ? Which types of evaporators are used in refrigeration systems ? Describe in brief. *4*

4. (a) Describe the working of a simple vapour absorption system with the help of a neat sketch. 7

(b) An ice plant operates between 35°C and – 15°C temperature limits. It produces 10,000 kg of ice per day from water at 30°C to ice at – 5°C. Assuming that the plant operates at a COP of 0·8 times the Carnot COP, calculate

(i) the capacity of plant in tons

(ii) the Carnot COP and actual COP of plant

(iii) the power consumption in kW

Given : Specific heat of water = 4·19 kJ/kg-K latent heat of fusion of ice = 335 kJ/kg specific heat of ice = 1·94 kJ/kg-K. 7

5. (a) Describe the problem of ozone layer depletion and global warming in brief. What is the contribution of refrigerants to these problems ? 4

(b) Define the following terms : 6

(i) Dew point temperature

(ii) Relative humidity

(iii) Wet bulb depression

(c) Draw the psychrometric chart and show the different constant property lines on it. 4

6. (a) Write short notes on the following : $3 \times 3 = 9$

(i) Multistage refrigeration system

(ii) Freeze drying

(iii) Marine refrigeration

(b) Describe the factors and causes of spoilage of food. 5