

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

Term-End Examination

00980

June, 2016

**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, Psychrometric chart, and Scientific calculator is permitted. Assume missing data suitably.

1. (a) Explain the vapour compression refrigeration cycle with the help of T-s and p-h diagrams.
(b) Discuss the effect of superheat and sub-cooling on the vapour compression refrigeration cycle. 7+7

2. (a) What are the different types of compressors used in vapour compression plants ? Explain with their applications.
(b) Derive an expression of COP for an air refrigeration system based on reversed Brayton cycle. 7+7

3. (a) What do you understand by cascade refrigeration system ? Explain it with the help of a flow chart and T-s diagram.
- (b) An air-water vapour mixture enters an adiabatic saturator at 30°C and leaves at 20°C , which is the adiabatic saturation temperature. The pressure remains constant at 100 kPa. Determine the relative humidity and the humidity ratio of the inlet mixture. 7+7
4. (a) Derive an expression for the maximum COP of an absorption refrigeration system.
- (b) What do you understand by dry bulb and wet bulb temperature ? 7+7
5. (a) What do you understand by saturated and unsaturated air ? Also state their importance.
- (b) Give the comparison between a vapour compression refrigeration system and a vapour absorption refrigeration system. 7+7
6. (a) A refrigeration cycle uses Freon-12 as the working fluid. The temperature of the refrigerant in the evaporator is -10°C . The condensing temperature is 40°C . The cooling load is 150 W and the volumetric efficiency of the compressor is 80%. The speed of the compressor is 720 rpm.

Calculate the mass flow rate of the refrigerant and the displacement volume of the compressor.

Properties of Freon-12.

Temperature (°C)	Saturation Pressure (MPa)	Enthalpy (kJ/kg)		Specific Volume (m ³ /kg) Saturated Vapour
		Liquid	Vapour	
- 10	0.22	26.8	183.0	0.08
40	0.96	74.5	203.1	0.02

- (b) An ice plant produces 10 tonnes of ice per day at 0°C, using water at room temperature of 20°C. Estimate the power rating of the compressor motor, if the COP of the plant is 2.5 and overall electromechanical efficiency is 90%. Take latent heat of freezing for water = 335 kJ/kg. Specific heat of water = 4.18 kJ/kg.

7+7

7. (a) 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.

(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) The COP of the refrigerator,
- (ii) The refrigerating effect per kW of input work, and
- (iii) The heat rejected to the condenser. 7+7

8. Write short notes on any *four* of the following : $4 \times 3 \frac{1}{2} = 14$

- (a) Cooling and Dehumidification
 - (b) Electrolux Refrigerator
 - (c) Dew Point
 - (d) Steam Ejector Refrigeration
 - (e) Refrigerant
 - (f) Winter Air Conditioning System
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