

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

**00752 Term-End Examination**

**December, 2017**

**BIME-015 : REFRIGERATION AND AIR  
CONDITIONING**

*Time : 3 hours*

*Maximum Marks : 70*

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*Note : Attempt any **seven** questions. All questions carry equal marks. Use of Steam table, Refrigeration charts, Mollier diagram, Psychrometric chart and Scientific calculator is permitted.*

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1. A domestic food freezer maintains a temperature of  $-15^{\circ}\text{C}$ . The ambient air temperature is  $30^{\circ}\text{C}$ . If heat leaks into the freezer at a continuous rate of  $1.75 \text{ kJ/sec}$ , what is the least power necessary to pump this heat out continuously ? 10
2. Explain the vapour compression cycle with the help of flow, T-s and p-h diagrams. 10
3. What is Refrigeration ? What is refrigerating effect ? What is a tonne of refrigeration ? 10

4. Derive the expression for the maximum COP of an absorption refrigeration system. 10
5. A refrigerator using R-134a operates on an ideal vapour compression cycle between 0.12 and 0.7 MPa. The mass flow of refrigerant is 0.05 kg/sec.
- Determine
- (a) the rate of heat removal from the refrigerated space,
  - (b) the power input to the compressor,
  - (c) the heat rejection to the environment, and
  - (d) the COP. 10
6. Atmospheric air at 1.0132 bar has a DBT of 32°C and a WBT of 26°C. Compute
- (a) the partial pressure of water vapour,
  - (b) the specific humidity,
  - (c) the dew point temperature,
  - (d) the relative humidity,
  - (e) the degree of saturation, and
  - (f) the density of air in the mixture. 10
7. What do you understand by saturated and unsaturated air? What is relative humidity? 10

8. A refrigeration machine is required to produce ice at  $0^{\circ}\text{C}$  from water at  $20^{\circ}\text{C}$ . The machine has a condenser temperature of 298 K while the evaporator temperature is 268 K. The relative efficiency of the machine is 50% and 6 kg of Freon-12 refrigerant is circulated through the system per minute. The refrigerant enters the compressor with a dryness fraction of 0.6. Specific heat of water is  $4.187 \text{ kJ/kg-K}$  and the latent heat of ice is  $335 \text{ kJ/kg}$ . Calculate the amount of ice produced in 24 hours. The table of properties of Freon-12 is given below :

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Temperature (K)	Liquid heat (kJ/kg)	Latent heat (kJ/kg)	Entropy of liquid (kJ/kg)
298	59.7	138.0	0.2232
268	31.4	154.0	0.1251

9. Discuss the effect of the following on the performance of a vapour compression system :
- Effect of suction pressure
  - Effect of delivery pressure
  - Effect of superheating
  - Effect of sub-cooling of liquid
  - Effect of suction temperature and condenser temperature

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10. Define a Unitary System. Where is it commonly preferred ? Explain a room air-conditioner with a neat sketch.

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