component vapour pressure of water is 3.166 kPa. 5

(iii) Explain the cooling tower's working and its types. 6

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# B.Tech Even Semester Examination, May, 2025

## Agricultural Engineering

(6th Semester)

## Course No: AE-B02

*(Refrigeration and Air Conditioning)*

*Full Marks: 70*
*Pass Marks: 28*
*Time: 3 hours*

**Note:**
1. Attempt any five questions taking one from each unit.
2. Begin each answer in a new page
3. Answer parts of a question at a place
4. Assume reasonable data wherever required
5. The figure in the right margin indicates full marks for the question
6. All the mathematical symbols and abbreviations have their usual meanings.

### UNIT-I

1. (i) Define refrigeration and air conditioning. 4

   (ii) Explain and discuss the classification of refrigeration systems. 6

   (iii) Write the importance of refrigeration in the food industry. 4

2. (i) What is ozone depletion? 4

   (ii) Discuss global warming issues in the context of refrigeration systems. 6

   (iii) Write desirable properties of refrigerant. 4

### UNIT-II

3. (i) Explain how the vapour compression refrigeration system works. 5

(ii) A reversed Carnot cycle is used to produce 1650 kJ/S to heat the space. The heat is taken from the atmosphere at 10°C and supplied to the conditioned room at 25°C. Find the kW required to run the system. 3

(iii) Explain the reversed Carnot cycle on the temperature-entropy diagram. 6

4. (i) Write a note on binary mixture of refrigerant. 4

(ii) Explain vapour enthalpy chart. 6

(iii) Discuss limitations of Carnot cycle. 4

**UNIT-III**

5. (i) Explain reciprocating compressor. Explain pressure–volume diagram of a reciprocating compressor for cylinder and piston mechanism. 8

(ii) Explain process of the rolling piston compressor in brief. 6

6. (i) What is condenser? Explain air-cooled, water-cooled, and evaporative condensers in brief. 8

(ii) How thermostatic expansion valve work? Explain with a neat diagram. 6

**UNIT-IV**

7. (i) Explain the working of the absorption cycle operation in the vapour absorption refrigeration system. 7

(ii) Compare vapour absorption and vapour compression refrigeration systems. 4

(iii) What is ammonia enrichment process? 3

8. (i) Derive the expression for the maximum COP of a heat-driven absorption refrigeration system:

$$COP = \frac{Q_e}{Q_g} \leq \left[\frac{T_g - T_c}{T_g}\right]\left[\frac{T_e}{T_c - T_e}\right]$$

Where:

$T_g$ : Generator (heat source) temperature

$T_c$ : Condenser/absorber (sink) temperature

$T_e$ : Evaporator (refrigerated space) temperature

$Q_e$: Cooling effect at the evaporator

$Q_g$: Heat supplied to the generator 5

(ii) Explain adiabatic mixing of two solution streams in simple absorption system. 3

(iii) What are the drawbacks of water vapour in the evaporator and condenser in the vapour absorption refrigeration system? 6

**UNIT-V**

9. (i) Explain absolute humidity, relative humidity, saturated humidity,and percentage humidity. 8

(ii) Explain heating, cooling, humidification, and condensation on the psychrometric chart. 6

10. (i) Write a short note onthe air Washer in detail. 3

(ii) The partial pressure of water vapor in a storage area, maintained at a temperature of 25 °C and a pressure of 101.3 kPa, is 2 kPa. Calculate the relative humidity and the percentage saturation. At 25 °C, the pure