

**THE KAVERY ENGINEERING COLLEGE**  
(An Autonomous Institution)

**B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL-MAY  
2025**

***Fifth Semester***

***Agricultural Engineering***

**AI3001 – Refrigeration and Cold Storage**

**(Steam Tables, Refrigeration and Air conditioning table and Psychrometry chart  
Can be Permitted)**

***Regulations - 2021***

***Duration : 3 Hrs***

***Maximum : 100 Marks***

***PART – A (ANSWER ALL QUESTIONS) (Marks 10\*2=20)***

| <b>Q.No</b> | <b>Questions</b>                                                                                               | <b>BLT</b> | <b>CO</b> | <b>Marks</b> |
|-------------|----------------------------------------------------------------------------------------------------------------|------------|-----------|--------------|
| 1.          | Define refrigeration effect.                                                                                   | L1         | 1         | 2            |
| 2.          | What is the function of a condenser in a refrigeration system?                                                 | L1         | 1         | 2            |
| 3.          | Draw a simple vapor compression cycle on a T-S diagram.                                                        | L1         | 2         | 2            |
| 4.          | What are the advantages and disadvantages of vapour absorption systems compared to vapour compression systems? | L2         | 2         | 2            |
| 5.          | Define relative humidity.                                                                                      | L1         | 3         | 2            |
| 6.          | What is the use of psychrometric chart?                                                                        | L1         | 3         | 2            |
| 7.          | Explain the concept of sensible heat factor and latent heat factor.                                            | L2         | 4         | 2            |
| 8.          | What is the significance of the by-pass factor in heat exchangers?                                             | L1         | 4         | 2            |
| 9.          | Define cold chain, and why is it important in food preservation?                                               | L1         | 5         | 2            |
| 10.         | List the various sensors used for cold storage management.                                                     | L1         | 5         | 2            |

***PART – B (ANSWER ALL QUESTIONS) (Marks 5\*16 = 80)***

| <b>Q.No</b> | <b>Questions</b>                                                                                  | <b>BLT</b> | <b>CO</b> | <b>Marks</b> |
|-------------|---------------------------------------------------------------------------------------------------|------------|-----------|--------------|
| 11.         | a i Discuss the factors affecting the coefficient of performance (COP) of a refrigeration system. | L3         | 1         | 10           |
|             | ii Describe the various units of refrigeration and their interconversions.                        | L3         | 1         | 6            |

**Or**

|     |                                                                                                                               |    |   |   |
|-----|-------------------------------------------------------------------------------------------------------------------------------|----|---|---|
| b i | Explain the working principle of each type of expansion device, highlighting its role in controlling the flow of refrigerant. | L3 | 1 | 8 |
| ii  | Analyze the factors affecting the performance of expansion                                                                    | L3 | 1 | 8 |

devices, such as refrigerant temperature, pressure, and flow rate.

- |     |   |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |    |   |    |
|-----|---|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|---|----|
| 12. | a | i  | Draw and analyze the T-s and p-h diagrams for the Domestic refrigeration cycle with Super heating and Subcooling, identifying the key processes involved.                                                                                                                                                                                                                                                                                                                           | L3 | 2 | 8  |
|     |   | ii | Discuss the importance of subcooling process and discuss how it affects the COP of a refrigeration system.                                                                                                                                                                                                                                                                                                                                                                          | L3 | 2 | 8  |
|     |   |    | <b>Or</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |    |   |    |
|     | b |    | Draw and analyze the schematic diagram of a lithium bromide-water absorption refrigeration system, identify the key components and their functions.                                                                                                                                                                                                                                                                                                                                 | L3 | 2 | 16 |
| 13. | a |    | Explain the key psychrometric properties: dry-bulb temperature, wet-bulb temperature, dew-point temperature, relative humidity, specific humidity, enthalpy, and volume.                                                                                                                                                                                                                                                                                                            | L3 | 3 | 16 |
|     |   |    | <b>Or</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |    |   |    |
|     | b |    | A room has the following heat gains:<br>(i) Sensible heat gain from people: 2 kW<br>(ii) Sensible heat gain from lights: 1 kW<br>(iii) Latent heat gain from people: 0.5 kW<br>(iv) Solar heat gain through windows: 3 kW<br>(v) Infiltration heat gain: 1 kW<br>The room has a volume of 100 m <sup>3</sup> . The desired indoor conditions are 22°C DB and 50% RH. The outdoor conditions are 35°C DB and 30% RH. Determine the total cooling load and the required airflow rate. | L3 | 3 | 16 |
| 14. | a | i  | Describe the factors affecting human thermal comfort, such as temperature, humidity, air velocity, and radiant heat exchange.                                                                                                                                                                                                                                                                                                                                                       | L3 | 4 | 8  |
|     |   | ii | Discuss the design considerations for residential and commercial comfort air conditioning systems, including load calculations and system sizing.                                                                                                                                                                                                                                                                                                                                   | L3 | 4 | 8  |
|     |   |    | <b>Or</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |    |   |    |
|     | b |    | Describe the key components and working principles of summer, and year-round air conditioning systems.                                                                                                                                                                                                                                                                                                                                                                              | L3 | 4 | 16 |
| 15. | a |    | Describe the methods used to estimate cooling and heating loads and discuss the use of heat balance equations and empirical correlations.                                                                                                                                                                                                                                                                                                                                           | L3 | 5 | 16 |
|     |   |    | <b>Or</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |    |   |    |
|     | b |    | A cold storage room requires a refrigeration capacity of 20 tons. The refrigerant used is R-134a. The evaporator temperature is -10°C, and the condenser temperature is 40°C. Determine the mass flow rate of the refrigerant and the power input to the compressor.                                                                                                                                                                                                                | L3 | 5 | 16 |