

CMR ENGINEERING COLLEGE: : HYDERABAD
UGC AUTONOMOUS

IV-B.TECH-I-Semester End Examinations (Supply) - December- 2025
REFRIGERATION AND AIR CONDITIONING
(MECH)

[Time: 3 Hours]

[Max. Marks: 70]

Note: This question paper contains two parts A and B.

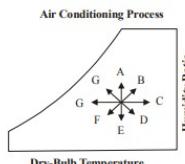
Part A is compulsory which carries 20 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART-A

(20 Marks)

1. a) Draw the line diagram of simple vapour compression refrigeration system. [2M]
- b) Difference between heat engine/refrigerator and heat pump. [2M]
- c) Explain sub cooling, super heating with sketch. [2M]
- d) Define relative COP. [2M]
- e) What is an azeotrope? [2M]
- f) What are desirable characteristics of absorbent in vapour absorption refrigeration cycle? [2M]
- g) Explain the working principle of thermoelectric refrigeration system. [2M]
- h) Name the processes B, C, E, G from the figure below. [2M]



- i) Distinguish clearly fan and blower. [2M]
- j) Show heating and dehumidification process on psychometric chart. [2M]

PART-B

(50 Marks)

2. a) Draw p-V and T-s diagrams of actual air refrigeration system and discuss the salient points. [5M]
- b) The capacity of a refrigerator is 200 TR when working between -6°C and 25°C . Determine the mass of ice produced per day from water at 25°C . Also, find the power required to drive the unit. Assume that the cycle operates on reversed Carnot cycle and latent heat of ice is 35 kJ/kg .
OR
 3. A dense air machine operates on reversed Brayton cycle and is required for a capacity of 10 TR. The cooler pressure is 4.2 bar and the refrigerator pressure is 1.4 bar. The air is cooled in the cooler at a temperature of 50°C and the temperature of air at inlet to the compressor is -20°C . The expansion and compression follows the Law $pV^{1.4} = \text{constant}$, Determine
 (i) COP,
 (ii) mass of air circulated per minute
 (iii) theoretical piston displacement of compressor,
 (iv) theoretical piston displacement of expander, and
 (v) Net power per tonne of refrigeration.
 Take C_p for air as 1 kJ/kg K .
 4. a) Explain the construction and use of P-H charts in refrigeration system. [5M]
 b) Define C.O.P. How C.O.P of refrigerators and heat pump can be evaluated?
OR
 5. Explain the working of Electrolux refrigeration system with neat sketch. Explain their drawbacks and benefits. [10M]

6. An air refrigerator working on Bell-Coleman cycle takes in air at 1 bar and at a temperature of 100^0 C. The air is compressed to 5 bar abs. The same is cooled to 250^0 C in the cooler before expanding in the expansion cylinder to cold chamber pressure of 1 bar. The compression and expansion laws followed are $PV1.35 = C$ and $PV1.3 = C$ respectively. Determine C.O.P of the plant and net refrigeration effect per kg of air. Take $C_p = 1.009$ kJ/kg K and $R = 0.287$ kJ/kg K for air. [10M]

OR

7. a) Explain a two stage compression system with liquid intercooler? [5M]
b) What is an eco-friendly refrigerant? Discuss the action plan to reduce ecological hazards. [5M]

8. a) Explain the procedure for calculating cooling load due to infiltration air. [5M]
b) A summer air conditioning system for a small office building is to be designed. The design is to be based on the following information: Outside design condition 350^0 C Tdb, 280^0 C Twb Inside design condition 260^0 C Tdb, 50% RH Room sensible heat gain 45 kW Room latent heat gain 9 kW Ventilation air $0.95\text{ m}^3/\text{s}$ A four row direct expansion refrigerant 134a coil with bypass factor of 0.2 is to be used. Analyze the problem on a psychometric chart and determine the following: i) The room apparatus dew point (ADP) ii) The temperature of the air leaving the coil iii) The total quality of air required (m^3/s). [5M]

OR

9. Explain the working of Steam Jet Refrigeration system with help of a diagram. [10M]

10. a) Atmospheric air at 16^0 C DBT and 25% RH passes through a furnace and then through a humidifier in such a way that the final DBT is 30^0 C and RH 50%. Determine: [5M]
i) Heat and moisture added to air.
ii) Sensible heat factor of the process.
b) How will you assign number to the refrigerants methyl chloride and tetrachloroethane? [5M]

OR

11. a) Describe a centrifugal fan with the help of a neat sketch. [5M]
b) Explain in detail about heat pump circuits. [5M]
