

Code No.: ME701PC

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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.

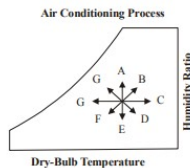
Part A is compulsory which carries 20 marks. Answer all questions in Part A.

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 zoetrope? [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 . [5M]

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 $p v^{1.4} = \text{constant}$, Determine [10M]
 - (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? [5M]

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°C . [10M]
The air is compressed to 5 bar abs. The same is cooled to 250°C in the cooler before expanding in the expansion cylinder to cold chamber pressure of 1 bar. The compression and expansion laws followed are $PV^{1.35} = C$ and $PV^{1.3} = C$ respectively. Determine C.O.P of the plant and net refrigeration effect per kg of air. Take $C_p = 1.009\text{ kJ/kg K}$ and $R = 0.287\text{ kJ/kg K}$ for air.

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 35°C Tdb, 28°C Twb Inside design condition 26°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 quantity 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°C DBT and 25% RH passes through a furnace and then through a humidifier in such a way that the final DBT is 30°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]
