

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)**

CLASS: BTECH
BRANCH: Mechanical

SEMESTER: VII
SESSION: MO/2025

SUBJECT: ME401 REFRIGERATION AND AIRCONDITIONING

TIME: 2 HOURS

FULL MARKS: 25

INSTRUCTIONS:

1. The total marks of the questions are 25.
 2. Candidates attempt for all 25 marks.
 3. Before attempting the question paper, be sure that you have got the correct question paper.
 4. The missing data, if any, may be assumed suitably.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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- Q1 List the processes involved in the Bell-Coleman cycle with the help of T-s diagram. Also derive the expression for COP. [5] **CO** **BL**
CO2 L3
- Q2 Explain the construction and working of Reduced ambient aircraft refrigeration system. Also show the various processes in T-s diagram. [5] CO1 L2
- Q3 An aircraft moving with speed of 900 km/h uses simple gas refrigeration cycle for air conditioning. The ambient pressure and temperature are 0.36 bar and -12 °C respectively. The pressure ratio of compressor is 5. The heat exchanger effectiveness is 0.94. The isentropic efficiencies of compressor and expander are 0.82 each. The cabin pressure and temperatures are 1.05 bar and 27 °C respectively. Determine:
(i) The temperatures and pressures at all the points of the cycle,
(ii) The volume flow rates through the compressor inlet and expander outlet for 90 tonnes refrigeration. [5] CO1 L3
- Q4 A CO₂ refrigerator works between 56.25 bar and 21.2 bar. The temperature of vapour leaving the compressor is 32 °C. Determine: (a) Dryness fraction of vapour entering and leaving the evaporator, (b) The COP. Take the enthalpy of CO₂ = 245.78 kJ/kg at the end of compression. [5] CO2 L3

Use the following properties of CO₂

Saturation Pressure (bar)	Saturation temperature, °C	Enthalpy (kJ/kg)		Entropy (kJ/kg K)	
		h _f	h _g	s _f	s _g
56.25	18.5	52.67	214.02	0.1672	0.7231
21.20	-15.0	-37.60	234.50	-0.1505	0.9154

- Q5 In a multi-stage vapor compression refrigeration system, both intercooling and a flash tank are employed to improve performance. Justify their necessity and functions with a neat, suitable sketch. [5] CO2 L3

:::18/09/2025 :::M