

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI (NEW) EXAMINATION – SUMMER 2024****Subject Code:2161908****Date:01-06-2024****Subject Name:Refrigeration and Air Conditioning****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		Marks
Q.1	(a) Define following terms: (1) Refrigeration, (2) Air conditioning and (3) One tone of refrigeration.	03
	(b) Explain two physical & two thermodynamic properties of Refrigerant.	04
	(c) In a refrigeration plant working on a Bell Coleman cycle, air is compressed to 5 bar from 1 bar. Its initial temperature is 10° C. After compression, the air is cooled up to 20° C in a cooler before expanding back to a pressure of 1 bar. Determine the theoretical C.O.P. of the plant and net refrigerating effect. Take $C_p = 1.005 \text{ kJ/kg K}$ and $C_v = 0.718 \text{ kJ/kg K}$.	07
Q.2	(a) What are the limitations of Carnot cycle for air refrigeration?	03
	(b) Explain Dalton's law of partial pressure. How evaporation happens in atmosphere?	04
	(c) Explain in brief simple air-refrigeration system. Show processes on T-s diagram and derive equation of COP in terms of temperatures.	07
	OR	
	(c) Explain working of Li-Br vapour absorption refrigeration system with neat sketch.	07
Q.3	(a) Explain the working of refrigeration cycle with two stage compression. What are the advantages over single compression system?	03
	(b) Explain construction and working of Thermostatic Expansion valve with neat sketch.	04
	(c) Two refrigerators A and B operate in series. The refrigerator A absorbs energy at the rate of 1 kJ/s from a body at temperature 300 K and rejects energy as heat to a body at temperature T. The refrigerator B absorbs the same quantity of energy which is rejected by the refrigerator A from the body at temperature T, and rejects energy as heat to a body at temperature 1000 K. If both refrigerators have the same C.O.P., calculate: 1. The temperature T of the body, 2. The C.O.P. of the refrigerators, and 3. The rate at which energy is rejected as heat to the body at 1000 K.	07
	OR	
Q.3	(a) Explain hermetically sealed compressor.	03
	(b) Vapour absorption refrigeration system is not as efficient as VCR cycle, Justify.	04

- (c) A conference room for seating 100 persons is to be maintained at 22° C dry bulb temperature and 60% relative humidity. The outdoor conditions are 40° C dry bulb temperature and 27° C wet bulb temperature. The various loads in the auditorium are as follows: 07
- Sensible and latent heat loads per person: 80 W and 50 W respectively, Lights and fans: 15000 W, Sensible heat gains through glass, walls, ceiling etc.: 15000 W.
- The air infiltration is 20 m³/min and fresh air supply is 100 m³/min. Two-third of recirculated room air and one-third of fresh air are mixed before entering the cooling coil. The by-pass factor of the coil is 0.1.
- Determine apparatus dew point, the grand total heat load and effective room sensible heat factor.

- Q.4** (a) What is the difference between Vapour compression refrigeration & Vapour absorption refrigeration system? 03
- (b) Define following terms: 04
- (1) Specific Humidity, (3) Relative Humidity,
(2) Dew point temperature, (4) Degree of saturation.
- (c) The atmospheric air of 760mm of Hg, dry bulb temperature 15° C and wet bulb temperature 11° C enters a heating coil whose temperature is 41° C. Assuming by-pass factor of heating coil as 0.5, determine dry bulb temperature, wet bulb temperature and relative humidity of the air leaving the coil. Also determine the sensible heat added to the air per kg of dry air. 07

OR

- Q.4** (a) Explain heating & humidification process. 03
- (b) Explain flywheel effect of building material and its use in design. 04
- (c) A rectangular duct section of 500 mm x 350 mm size carries 75 m³/min of air having density of 1.15 kg/m³. Determine the equivalent diameter of a circular duct if (a) the quantity of air carried in both the cases is same, and (b) the velocity of air in both the cases is same. If $f = 0.01$ for sheet metal, find the pressure loss per 100 m length of duct. 07
- Q.5** (a) When dehumidification of air is necessary? How it is achieved? 03
- (b) State and explain various heat loads to be considered for cooling load calculation of typical building. 04
- (c) Define term “Effective Temperature” and explain the factor affecting effective temperature. 07

OR

- Q.5** (a) List out factors affecting human thermal comfort and explain any one. 03
- (b) Compare windows air conditioning system with split air conditioning system. Mention advantages of each. 04
- (c) Describe the different methods of air conditioning duct design. Why are dampers required in some systems? 07
