Name:

Enrolment No:

UPES

End Semester Examination, May 2024

Course: Refrigeration and Cold Chain **Semester: IV**

Program: B.Tech Food Technology **Time : 03 hrs.**

Course Code: MECH2138 **Max. Marks: 100**

Instructions: Assume suitable value of parameters/variables if not given in any question.
Use the psychometric chart given at the end.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	(a) Differentiate between primary and secondary refrigerants. (b) State the properties of the good refrigerant.	**4**	**CO1**
Q 2	Explain the Bypass Factor (BPF) and Apparatus Dew Point (ADP) temperature.	**4**	**CO2**
Q 3	Define Air Change load and Product Load in cooling chamber design.	**4**	**CO2**
Q 4	A sample of air has dry and wet bulb temperatures of 35°C and 25°C, respectively. The barometric pressure is 760 mm Hg. Calculate (a) Humidity ratio, (b) relative humidity, and (c) enthalpy of the sample.	**4**	**CO2**
Q 5	Enumerate some common methods being used for food preservation.	**4**	**CO2**

SECTION B
(4Qx10M= 40 Marks)

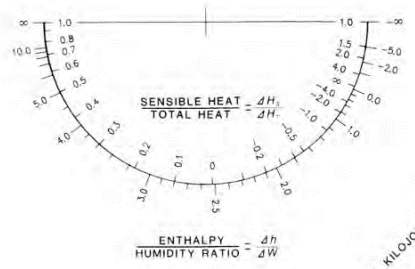
Q 6	The table provides steady-state operating data for a vapour-compression refrigeration cycle using R-134a as the working fluid. **State** | **1** | **2s** | **2** | **3** | **4** ***h* (kJ/kg)** | **241.35** | **272.39** | **280.15** | **91.49** | **91.49** For a refrigerant mass flow rate of 0.08 kg/s, determine the (a) compressor power, in kW, (b) refrigeration capacity, in tons, (c) coefficient of performance, (d) isentropic compressor efficiency	**10**	**CO3**

Q 7	The air-handling unit of an air-conditioning plant supplies a total of 4500 cmm of dry air, which comprises by weight 20 per cent fresh air at 40°C DBT and 27°C WBT, and 80 per cent recirculated air at 25°C DBT and 50 per cent RH. The air leaves the cooling coil at a 13°C saturated state. Calculate the total cooling load, and room heat gain. Draw the process on the psychrometric chart.	**10**	**CO3**
Q 8	Explain the advantages of freezing. Also, explain the effect of freezing in terms of Slow Freezing and Quick Freezing.	**10**	**CO4**
Q 9	Explain the benefits and limitations of the Controlled and Modified Atmosphere storage system. **OR** Explain the advantages and limitations of controlled atmosphere storage of cereals and Oilseeds.	**10**	**CO3**
	SECTION-C **(2Qx20M=40 Marks)**		
Q 10	Elaborate on the design and construction process of cold storage considering the following factors (a) Classification/types (b) Heat loads (c) Insulation (d) Temperature and humidity control (e) Vapor barrier (f) Air moment and (g) Stacking and material handling (h) General considerations. ***OR*** A 100% outdoor summer air conditioning system has a room sensible heat load of 400 kW and a room latent heat load of 100 kW. The required inside conditions are 24°C and 50% RH, and the outdoor design conditions are 34°C and 40% RH. The air is supplied to the room at a dry bulb temperature of 14°C. Find (a) the required mass flow rate of air (b) the moisture content of supply air, (c) Sensible, latent heat loads on the coil, and d) The required cooling capacity of the coil, Coil Sensible Heat Factor and coil ADP if the by-pass factor of the coil is 0.2. Barometric pressure = 1 atm. Comment on the results.	**20**	**CO5**
Q 11	The chilling room of a meat plant is 15 m × 18 m × 5.5 m in size and has a capacity of 350 meat carcasses. The power consumed by the fans and the lights in the chilling room are 22 kW and 2 kW, respectively, and the room gains heat through its envelope at a rate of 14 kW. The average mass of meat carcasses is 220 kg. The carcasses enter the chilling room at 35°C after being washed to facilitate evaporative cooling and are cooled to 16°C in 12 h. The air enters the chilling room at -2.2°C and leaves at 0.5°C. Determine (a) the refrigeration load of the chilling room and (b) the volume flow rate of air. The average specific heats of meat carcasses and air are 3.14 and 1.0 kJ/kg°C, respectively, and the density of air can be taken to be 1.28 kg/m^3.	**20**	**CO5**

ASHRAE PSYCHROMETRIC CHART NO. 1

NORMAL TEMPERATURE SEA LEVEL

BAROMETRIC PRESSURE 101.325 kPa.



Prepared by: CENTER FOR APPLIED THERMODYNAMIC STUDIES, University of Idaho