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Uni. Roll No.

MORNING

21 SEP 2022

Program/ Course: B. Tech. (2018)

Semester: 6th

Name of Subject: Refrigeration and Air Conditioning

Subject Code: PCME-116

Paper ID: 17253

Time Allowed: 03 Hours

Max. Marks: 60

NOTE:

- 1) Scientific calculator is allowed.
- 2) **Part A and B are compulsory.**
- 3) **Part C** has Two Questions **Q8** and **Q9**. Both are compulsory, but with internal choice.
- 4) Any missing data may be assumed appropriately.
- 5) Use of refrigeration chart is allowed.

SECTION- A

[Marks: 2 each]

Q1.

- a) Define bypass factor of cooling coil.
- b) What is DART?
- c) Write the chemical name and formula for R12 and R134a refrigerant.
- d) State the factors that determine human comfort.
- e) Why ducts are used in air conditioning system?
- f) What are Azeotropes?

SECTION- B

[Marks: 4 each]

- Q2.** An ammonia refrigerator works between -6.7°C and 26°C . The vapour is dry-saturated at the end of compression. Calculate (a) theoretical COP, (b) Power required to drive the compressor if the cooling capacity of the refrigerator is 5 tons. Use of the following properties of NH_3 .

Temp. ($^{\circ}\text{C}$)	Specific enthalpy (kJ/kg)		Specific entropy (kJ/kg-K)	
	Liquid (h_f)	Saturated vapour (h_g)	Liquid (s_f)	Saturated vapour (s_g)
-6.7	-29.26	1262.36	0.1087	4.7401
26	124.56	1291.62	0.4264	4.3263

- Q3.** Draw the line diagram and Ts chart for boot-strap air evaporative cooling system and derive the expression for COP of this system.
- Q4.** What is effective temperature? Discuss the factors that affect the optimum effective temperature.
- Q5.** In a heating application, moist air enters a steam heating coil at 10°C , 50% RH and leaves at 30°C . Determine the sensible heat transfer, if mass flow rate is air is 100 kg of dry air per second. Also determine the steam mass flow rate if steam enters saturated at 100°C and condensate leaves at 80°C .
- Q6.** What are the desirable thermodynamic properties of refrigerants? Discuss in detail.

Q7. Drive an expression for COP of three stage compression with water intercoolers with a neat line diagram and p-h chart.

SECTION- B

[Marks: 12 each]

Q8. A small office hall of 25 persons capacity is provided with summer air conditioning system with the following data:

Outside conditions	=	34°C DBT and 28°C WBT
Inside conditions	=	24°C DBT and 50% RH
Volume of air supplied	=	0.4 m ³ / min /person
Sensible heat load in room	=	125600 kJ/h
Latent heat load in the room	=	42000 kJ/h

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Find the sensible heat factor of the plant.

OR

An aircraft refrigeration plant has to handle a cabin load of 30 tones. The atmospheric temperature is 17°C. The atmospheric air is compressed to a pressure of 0.95bar and temperature of 30°C due to ram action. This air is then further compressed in a compressor to 4.75bar, cooled in a heat exchanger to 67°C, expanded in a turbine to 1 bar pressure and supplied to the cabin. The air leaves the cabin at a temperature of 27°C. The isentropic efficiencies of both compressor and turbine are 0.9. Calculate the mass of air circulation per minute and the COP. For air, $c_p = 1.004$ kJ/kgK and $c_p/c_v = 1.4$.

Q9. At certain locality, the dry bulb temperature of air is 30°C and the relative humidity is 40%. Determine the specific humidity and the dew point and wet bulb temperature of air. If this air is cooled in an air washer using recalcitrated spray water and having a humidifying efficiency of 0.9, what are dry bulb temperature and dew point temperature of air leaving the air washer?

OR

- Discuss the inorganic refrigerants. (4)
- What is heating and humidification? Discuss in details with neat diagram. Also find the SHF for the heating and humidification. (6)

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