PVP 20

Code: 20ME4501E

III B.Tech - I Semester – Supplementary Examinations
NOVEMBER 2024

REFRIGERATION AND AIR CONDITIONING
(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

BL – Blooms Level CO – Course Outcome

		UNIT – I	
1.	a)	The atmospheric air at pressure 1 bar and temperature -5°C is drawn in the cylinder of the compressor of a Bell-Coleman refrigerating machine. It is compressed isentropically to a pressure of 5 bar. In the cooler, the compressed air is cooled to 15°C, pressure remaining the same. It is then expanded to a pressure of 1 bar in an expansion cylinder, from where it is passed to the cold chamber. Find: (i) the work done per kg of air, and (ii) C.O.P. of the plant. For air assume law for expansion, $pv^{1.2}$ = constant; law for compression, $pv^{1.4}$ = constant and specific heat of air at constant pressure = 1 kJ/kg K.	7 M
	b)	Explain, with a neat sketch, the working principle of boot-strap evaporative type of air refrigeration system. Draw T-s diagram for the system.	7 M
		OR	
2.	a)	A simple air-cooled system is used for an aeroplane having a load of 9 tonnes. The atmospheric pressure and temperature are 0.9 bar and 10°C respectively.	7 M

		During ramming pressure increases to 1.013 bar. In the heat exchanger, the temperature of air is reduced by 55°C. The pressure in the cabin is 1.01 bar and the temperature of air leaving the cabin is 25°C. Determine: (i) Power required to take the load of cooling in the cabin; (ii) C.O.P. of the system. Assume that all the expansions and compressions are isentropic. The pressure of the compressed air is 4 bar.	
	b)	Explain with a neat sketch the reduced ambient air refrigeration system.	7 M
		UNIT – II	
3.		A refrigerating plant works between temperature limits of -5°C and 25°C. The working fluid ammonia has a dryness fraction of 0.62 at entry to compressor. If the machine has a relative efficiency of 55%, calculate the amount of ice formed during a period of 24 hours. The ice is to be formed at 0°C from water at 15°C and 6.4 kg of ammonia is circulated per minute. Specific heat of water is 4.187 kJ/kg k and latent heat of ice is 335 kJ/kg. Properties of NH3 (datum - 40°C).	14 M

Temp. °C	Liquid heat kJ/kg	Latent heat kJ/kg	Entropy of liquid kJ/kg K
25	298.9	1167.1	1.124
-5	158.2	1280.8	0.630

		OR	
4.	a)	With a neat sketch explain the working of flooded type evaporator.	7 M
	b)	Define a Refrigerant. Discuss any 6 desirable properties of refrigerants.	7 M

		UNIT-III	
5.		Draw a neat diagram of Lithium bromide water absorption refrigeration system and explain its working. List-out the major fields of applications of this refrigeration system.	14 M
		OR	
6.	a)	Explain the working of a steam jet refrigeration system with the help of a neat sketch.	7 M
	b)	List out the advantages, disadvantages and applications of the vortex tube.	7 M
		UNIT – IV	
7.	a)	Explain (i) cooling and dehumidification, (ii) sensible heating.	7 M
	b)	A mixture of dry air and water vapour is at a temperature of 22°C under a total pressure of 730 mm Hg. The dew point temperature is 15°C. Find : (i) Partial pressure of water vapour (ii) Relative humidity (iii) Specific humidity (iv) Enthalpy of air per kg of dry air (v) Specific volume of air per kg of dry air.	7 M
		OR	
8.	a)	For a hall to be air-conditioned, the following conditions are given: Outdoor condition: 39°C DBT, 20°C WBT, Required comfort condition.: 20°C DBT, 60% RH Seating capacity of hall: 1200 Amount of outdoor air supplied : 0.3 m^3/min per person If the required condition is achieved first by adiabatic humidification and then by cooling determine:	7 M

		(i) Capacity of the cooling coil in tonnes; and (ii) Capacity of the humidifier in kg/h	
	b)	Explain the procedure to draw a Grand sensible heat factor (GSHF) line on a psychrometry chart.	7 M
		UNIT – V	
9.	a)	What is an 'Effective temperature'? Explain 'Effective temperature chart' and 'Comfort chart'.	7 M
	b)	250 m^3/min of air at atmospheric conditions 12°C DBT and 50% RH is supplied to an conditioned hall. The required conditions are 18°C DBT and 60% RH. Determine: (i) Sensible heat and latent heat removed from the air per minute, and (ii) Sensible heat factor for the system.	7 M
		OR	
10.	a)	With the help of neat sketch explain the working of summer air-conditioning system.	7 M
	b)	Explain the working of axial flow and centrifugal fans with suitable sketches.	7 M