PVP 20

Code: 20ME4501E

III B.Tech - I Semester – Regular Examinations - DECEMBER 2022

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

			BL	CO	Max. Marks
		UNIT-I			
1	a)	How do you explain the necessity of providing air conditioning to the air crafts?	L2	CO1	5 M
	b)	An air refrigeration system working on Bell-Coleman cycle takes air into compressor to 5 bar and cooled to 25^0 C at the same pressure. It is further expanded in an expander to 1 bar and discharged to take cooling load. The isentropic efficiencies of the compressor and expander are 80 % and 85 % respectively. Calculate (i) Refrigeration Capacity of the system if the air circulated is 40Kg/min. (ii) HP required to run the compressor and (iii) COP of the system.	L4	CO1	9 M
		OR			
2	a)	With a neat sketch explain Bootstrap air refrigeration system with evaporative cooling method.	L3	CO1	5 M

	b)	A dense air refrigeration cycle operates between the pressures of 3 bar and 15 bar. The air temperature after heat rejection to surroundings is 27^0C and air temperature at exit of the refrigerator is 3^0C. Determine compressor and turbine work per TR. Take $\gamma = 1.4$ and $C_p = 1.005$kJ/kg K	L4	CO1	9 M
		UNIT-II			
3	a)	With a neat sketch, explain the working principle of a Thermo Static Expansion valve.	L3	CO2	5 M
	b)	R-717 refrigerator based on ideal Vapor compression cycle operates between the temperature limits of -20^0C and 40^0C. The refrigerant enters the condenser as saturated vapor and leaves as saturated liquid in condenser. If the refrigerant circulation is 0.025kg/s, find (i) COP (ii) dimensions of the compressor, if L:D = 1.5,N=2500RPM. c_{pl}=4.583kJ/kg K, c_{pv}=4.825kJ/kg K.	L4	CO2	9 M
		OR			
4	a)	With a neat sketch, explain the working principle of a Evaporative Condenser.	L3	CO2	5 M
	b)	A refrigeration plant operates in quasi- ideal Vapor compression cycle. The R-12 is used having Saturation temperatures in the evaporator and condenser as -5^0 C and 40^0C respectively. The vapor enters the compressor as a saturated vapor and is sub cooled to 20^0C before entering the throttle valve. Calculate (i) Work done per Kg of refrigeration. (ii) RE/kg of Refrigeration (iii) COP. Take cpl=0.923kJ/kg K, cpv=0.988kJ/kg K	L4	CO2	9 M

		UNIT-III			
5	a)	Explain the working principle of Lithium bromide-Water Vapor Absorption refrigeration System with a neat sketch.	L3	CO2	7 M
	b)	Demonstrate the working principle of a vortex tube refrigeration system with a neat sketch.	L3	CO2	7 M
		OR			
6	a)	With a neat sketch, derive the COP of a simple vapor absorption refrigeration system.	L3	CO2	7 M
	b)	Demonstrate the working principle of a Electrolux vapor absorption refrigeration system with a neat sketch.	L3	CO2	7 M
		UNIT-IV			
7	a)	Explain i) Dew point temperature ii) Saturated air iii) Wet bulb depression iv) Air conditioning v) Psychrometry in detail.	L2	CO1	5 M
	b)	The pressure, dry bulb temperature and relative humidity of air in a room are 1 bar, $30\ ^0$C and 70%, respectively. If the saturated pressure at $30\ ^0$C is 4.25 kPa , Determine the specify humidity of the room air in kg water vapor / kg dry air.	L4	CO3	9 M
		OR			
8	a)	Show the adiabatic dehumidification and adiabatic saturation processes on Psychrometric Chart. Explain their significance.	L3	CO3	5 M
	b)	Dew point temperature of air at one atmospheric pressure (1.013 bar) is 18^0 C. The air-dry bulb temperature is $30\ ^0$C. The saturation pressure of water at 18^0 C and 30^0 C are 0.02062 bar and 0.04241 bar respectively. The specific heat of air and water vapor respectively are 1.005 and 1.88 kJ / kg K	L4	CO3	9 M

		and the latent heat of vaporization of water at 0^0 C is 2500 kJ / kg. Determine the specific humidity (kg/ kg of dry air) and enthalpy (kJ / kg or dry air) of this moist air respectively.			
UNIT-V					
9	a)	Illustrate in detail Human comfort and Industrial air conditioning requirements.	L3	CO3	5 M
	b)	A library hall is to be maintained at 24^0 C DBT and 50% R.H. When ambient conditions are 38^0 C DBT and 40%R.H. The room sensible and latent heat gains are 1, 25,000 KJ/hr and 68,000 KJ/hr respectively. The ventilation is 65 m^3/min. Minimum temperature of air supplied to the room = 17^0 C. Determine: i) Grand total heat ii) ERSHF iii) ADP iv) Dehumidified air quantity. Take bypass factor of cooling coil as 0.1.	L4	CO3	9 M
OR					
10	a)	Relate the factors, which affect the Human Comfort and Effective Temperature.	L3	CO3	5 M
	b)	A Metrological laboratory is to be air conditioned for inside design conditions of 25^0 C DBT and 50% R.H. When ambient conditions are 40^0 C DBT and 27^0 C WBT. The room sensible and latent heat gains are 14.5 KW and 3.2 KW respectively. The minimum fresh air requirement is 50 m^3/min. Minimum temperature of air supplied to the room = 19^0 C. Determine i) Ventilation load ii) ERSHF iii) ADP iv) Dehumidified air quantity. Take bypass factor of cooling coil as 0.15.	L4	CO3	9 M