Subject Code…… **ROLL NO……**

SEMESTER EXAMINATION 2022-23
1st year M.Tech. Thermal Engineering

Refrigeration and Air-Conditioning System Design(TET-316)

Duration : 3 hrs **Max. Marks: 100**

Note:- Attempt all questions. All question carry equal marks. In case any ambiguity or missing data, the same may be assumed and state the assumption made in the answer.

Q.1.	**Answer any four parts of the following.**	**5×4=20**
	a) What are the factors governing optimum effective temperature b) Explain enthalpy of moisture. c) What is year round air conditioning? d) What are ecofriendly refrigerants? e) Discuss Winter air conditioning. f) What is adiabatic saturation.	
Q.2.	Answer any four parts of the following.	5×4=20
	a) Discuss two fluid and three fluid refrigeration systems. b) Explain the Properties of air-vapour mixture. c) Discuss Single stage compression and multistage compression systems. d) Discuss Summer air conditioning. e) Write short notes on cooling towers. f) Discuss working of expansion devices used in refrigeration system.	
Q.3.	Attempt any two parts of the following.	10×2=20
	a) Moist air at total pressure of 1.01325 bar and 25^0C dry bulb temperature (DBT), at DBT the saturation pressure of water vapour is 0.031 bar. If the degree of saturation is 50% , then determine partial pressure of water vapour at dew point temperature and specific volume of moist air. b) Explain advantage compound vapour compression refrigeration system over single stage vapour compression refrigeration system and also discuss the term sectionalizing. c) A vapour compression refrigerator uses methyl chloride (R40) and operates between temperature limits of -10 ^{0}C and 45^0C. At entry to the compressor, the refrigerant is dry saturated and after	

compression it acquires a temperature of 60^0C. Find the C.O.P of the refrigerator.

The properties of the methyl chloride (R40) are as under:

Saturation Temp (^{0}C)	Enthalpy(kJ/kg)		Entropy(kJ/kg K)	
	Liquid(h_f)	Vapour(h_g)	Liquid (s_f)	Vapour (s_g)
-10	45.4	460.7	0.183	1.637
45	133	483.6	0.485	1.587

Q.4.	Attempt any two parts of the following.	10×2=20
	a) A sample of air at dry-bulb temperature (DBT) is 35°C, wet-bulb temperature (WBT) is 25 °C and the barometer reads 101.325 kPa. The saturation pressure of water vapour at WBT and DBT are 3.17 kPa and 5.63 kPa. Calculate the humidity ratio, relative humidity and enthalpy of the sample. Also find humidity ratio if air were adiabatically saturated. b) Discuss the working of cascade refrigeration system and also derive COP of cascade refrigeration system. c) Describe the effect of subcooling, suction pressure and discharge pressure on performance of vapour compression refrigeration system with the help of p-h plots.	
Q.5.	Attempt any two parts of the following.	10×2=20
	a) A Bell-Coleman refrigerator works between 1 and 6 bar pressure limits. The temperatures of air at the beginning of compression and expansion to be 7^0C and 37 ^{0}C respectively. The compression and expansion indices are 1.25 and 1.3 calculate the theoretical C.O.P of the system. For air take γ = 1.4, C_p= 1.004 kJ/kg.	

	b) Discuss the classification of refrigerants and also explain selection criterion of refrigerants. c) Discuss working principle thermo electric refrigeration and its applications.	