GUJARAT TECHNOLOGICAL UNIVERSITY
BVOC- SEMESTER–I EXAMINATION – WINTER 2022

Subject Code:21110401   **Date:21-02-2023**
Subject Name:Basics of Refrigeration
Time:10:30 AM TO 12:30 PM   **Total Marks:50**
Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Define Refrigeration. Give applications of refrigeration.	**05**
	(b)	What is the unit of refrigeration in SI system? Explain 1 Ton of Refrigeration.	**05**
Q.2	**(a)**	Give detailed classification of various refrigeration system.	**05**
	(b)	What do you mean by COP? Explain in detail.	**05**

OR

	(b)	Derive the condition for maximum value of COP in case of Bell Coleman cycle.	**05**
Q.3	**(a)**	Explain Carnot refrigeration cycle with P-V and T-S diagrams and derive its COP.	**05**
	(b)	A dense air refrigerator operating on Bell-Coleman cycle works between 3 bar and 15 bar. The temperature of air after the evaporator and after cooler is 5°C and 20°C respectively. The evaporator extracts 2000 kJ/min of heat from the space to be cooled. Calculate (1) amount of air required in the cycle per minute, (2) power required to run the system, (3) COP and (4) mass flow rate of water per minute in cooler if rise in temperature of water is 20°C. Assume isentropic compression and expansion, Cp=1.008 kJ/kg K, γ=1.4 for air and for water Cp=4.18 kJ/kg K.	**05**

OR

Q.3	**(a)**	Explain Bell-Coleman refrigeration cycle with P-V and T-S diagrams and derive its COP.	**05**
	(b)	A refrigerator unit working on bell-Coleman cycle takes air at -10°C and compress it from 1bar to 6.5 bar with compression index of 1.2. The compressed air is cooled to a temperature 5°C above the ambient temperature of 25°C before it is expanded in the expander where the index of expansion is 1.35. Determine: (1) COP (2) capacity of plants in ton of refrigeration (3) quantity of air circulated per minute for production of 2000 kg of ice per day at 0°C from water at 20°C.	**05**
Q.4	**(a)**	Explain standard VCR system with schematic diagram. Also draw p-h diagram for the same.	**05**

(b) A vapour compression refrigerator uses methyl chloride (R-40) and operates between temperature limits of -10°C and 45°C. At entry to the compressor, the refrigerant is dry saturated and after compression it acquires a temperature of 60°C. Find the C.O.P. of the refrigerator. The relevant properties of methyl chloride are as follows **05**

saturation tempurate in °C	Enthalpy in kJ/kg		Entropy in kJ/kg K	
	Vapour	Liquid	Vapour	Liquid
-10°C	460.7	45.4	0.183	1.637
45	483.6	133.0	0.485	1.587

OR

Q.4 (a) Explain effect of sub cooling and super heating on the performance of VCR system. **05**

(b) A refrigeration machine using R-12 as refrigerant operates between the pressures 2.5 bar and 9 bar. The compression is isentropic and there is no undercooling in the condenser. The vapour is in dry saturated condition at the beginning of the compression. Estimate the theoretical coefficient of performance. If the actual coefficient of performance is 0.65 of theoretical value, calculate the net cooling produced per hour. The refrigerant flow is 5 kg per minute. Properties of refrigerant are: **05**

Pressure, bar	saturation tempurate in °C	Enthalpy in kJ/kg		Entropy of saturatedvapour, kJ/kg. K
		Liquid	Vapour	
9.0	36	70.55	201.8	0.6836
2.5	-7	29.62	184.5	0.7001

Q.5 (a) Explain House hold refrigerator with neat sketch. **05**

(b) Explain construction and working of NH_3-H_2O VAR system with neat sketch. **05**

OR

Q.5 (a) Differentiate between wet compression and dry compression. **05**

(b) Explain construction and working of LiBr-H_2O VAR system with neat sketch. **05**

****** ALL THE BEST ******