Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– IV(NEW) EXAMINATION – SUMMER 2023

Subject Code:3143507 Date:07-07-2023

Subject Name:Fundamentals of Stoichoimetry

Time:10:30 AM TO 01:00 PM Total Marks:70

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)**	Differentiate between fundamental and derived units with examples of each.	**03**
	(b)	Define the following terms: (a) Molality (b) Molarity (c) Normality and (d) ppm	**04**
	(c)	Show that for a mixture of ideal gasses: *Volume% = Mole% = Partial Pressure%*	**07**
Q.2	**(a)**	Differentiate between steady and unsteady processes.	**03**
	(b)	How many moles of carbon will contain 120 kg of carbon tetrachloride?	**04**
	(c)	Assuming air to contain 79% N_2 and 21% O_2 on volume basis, calculate the average molecular weight and density of air at NTP.	**07**
		OR	
	(c)	LPG gas has the following composition in weight%:	**07**

Components	CH_4	C_2H_6	N_2	CO_2
Weight%	65	15	15	5

Assuming it to be an ideal gas mixture, calculate volume%, mole%, partial pressure%, average molecular weight and density of the gaseous mixture at STP.

Q.3	**(a)**	Define Rault's law and Henry's law.	**03**
	(b)	Mention the procedure to solve material balance problems involving no chemical reactions.	**04**
	(c)	A single effect evaporator is fed with 10000 kg/h of weak liquor containing 15% caustic by weight and is concentrated to get thick liquor containing 40% by weight of caustic. Calculate (a) kg/h of water evaporated and (b) kg/h of thick liquor obtained.	**07**
		OR	
Q.3	**(a)**	Define Dalton's law and Amgat's law.	**03**
	(b)	Mention the difference between limiting reactant and excess reactant with examples.	**04**
	(c)	The feed to a continuous fractionating column analyses 28% by weight of benzene and 72 % toluene. The analysis of distillate shows 52 weight% benzene and 5 wt% benzene was found in bottom product. Calculate the amount of distillate and bottom product per 1000 kg of feed per hour. Also calculate the percentage recovery of benzene.	**07**
Q.4	**(a)**	Define Hess law of constant heat summation.	**03**
	(b)	Discuss recycle, by-pass and purge operations.	**04**
	(c)	In production of sulphur trioxide 100 kmol of SO_2 and 200 kmol O_2 are fed to reactor. The product stream is found to contain 80 kmol SO_3. Find the percent conversion of SO_2.	**07**

OR

Q.4	**(a)**	Differentiate between heat of combustion and heat of reaction.	**03**
	(b)	Explain the difference between percentage conversion, selectivity and yield.	**04**
	(c)	A combustion chamber is fed with 50 kmol/h of butane and 200 kmo/h of air. Calculate the percent excess air used and composition of gases leaving combustion reactor assuming complete combustion of butane.	**07**
Q.5	**(a)**	Discuss sensible heat and latent heat.	**03**
	(b)	Discuss the various enthalpy changes that take place during a chemical reaction.	**04**
	(c)	100 kg/h of methanol liquid at a temperature of 303 K is to be obtained by removing heat from saturated methanol vapour. Find out the amount of heat to be removed in above case **Data:** Boiling point of methanol = 337.8 K Latent heat of condensation of methanol = 1101.7 kJ/kg Specific heat of methanol = 2.72355 kJ/(kg K)	**07**

OR

Q.5	**(a)**	Explain the difference between gross calorific value and net calorific value.	**03**
	(b)	Discuss the difference between latent heat of vaporization and latent heat of combustion.	**04**
	(c)	A stream of nitrogen is flowing at a rate of 100 kmol/h is heated from 303 K to 373 K. Calculate the heat that must be transferred. C^0_P *for nitrogen* $= 29.5909 - (5.141 \times 10\text{-}3\ T) + (11.1829 \times 10\text{-}6\ T^2) - (4.968 \times 10\text{-}9\ T^3)$	**07**

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