GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–V (NEW) EXAMINATION – WINTER 2021

Subject Code:3150405   **Date:17/12/2021**
Subject Name:Chemical Engineering Fundamentals II
Time:02:30 PM TO 05:00 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.**

Q.1	**(a)**	Write about estimation of diffusivity of liquids.	**03**
	(b)	Explain criteria of solvent selection for gas absorption.	**04**
	(c)	Which are different theories explaining the meaning of mass transfer coefficients? Explain Film theory in detail.	**07**
Q.2	**(a)**	Define the following terms: i) order of reaction ii) elementary and non-elementary reactions	**03**
	(b)	Derive the performance equation of a mixed flow reactor.	**04**
	(c)	Write a short note on differential method and integral method of analysis of kinetic data.	**07**

OR

	(c)	Explain ideal and non-ideal solutions.	**07**
Q.3	**(a)**	Explain the classification of reaction in details with examples.	**03**
	(b)	State Fick's first law of diffusion and explain flux N_A and J_A.	**04**
	(c)	Explain gas phase controlled and liquid phase controlled mass transfer operations with the help of two-resistance theory of interphase mass transfer.	**07**

OR

Q.3	**(a)**	Discuss temperature dependency of activation energy using Arrhenius theory.	**03**
	(b)	State common principles of equilibrium in case of interphase mass transfer.	**04**
	(c)	Explain classification of mass transfer operations with examples of each.	**07**
Q.4	**(a)**	Define F type and k type mass transfer coefficients.	**03**
	(b)	Derive performance equation for a PFR.	**04**
	(c)	The rate constant of a reaction is measured at different temperatures is reported below. Calculate the activation energy for this reaction.	**07**

Temperature, K	273	293	303	313
Rate constant, k, sec^{-1}	2.46 x 10^5	47.5 x 10^5	576 x 10^5	5480 x 10^5

OR

Q.4	**(a)**	Explain concept of effective diffusivity for multicomponent mixtures.	**03**
	(b)	Compare momentum, heat and mass transfer.	**04**
	(c)	Explain preparation of solids for leaching.	**07**
Q.5	**(a)**	Mention different types of solid diffusion.	**03**
	(b)	Define the terms: liquid extraction, extract, raffinate and solvent.	**04**
			07

(c) In an $O_2 - N_2$ gas mixture at 1 atm pressure and 25^0C, the concentration of Oxygen at two planes 2 mm apart are 10 and 20 volume% respectively. Calculate flux of diffusion of O_2 for the case where N_2 is non-diffusing. $D_{O_2 - N_2} = 2.065 \times 10^{-5}$ m^2/s.

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OR

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Q.5 **(a)** Discuss parallel reactions with examples. Also discuss selectivity for parallel reaction.   **03**
(b) Write a short note on variable volume batch reactor.   **04**
(c) For a given liquid flow rate, give step wise procedure to calculate minimum liquid to gas ratio for absorbers.   **07**

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