

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V (NEW) EXAMINATION – WINTER 2022****Subject Code:3150405****Date:09-01-2023****Subject Name:Chemical Engineering Fundamentals II****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.

- Q.1** (a) Define the following terms: **03**
 i) molecularity ii) order of reaction iii) non-elementary reactions
 (b) Explain different types of packing used in an absorption tower. **04**
 (c) Write a short note on differential method and integral method of analysis of kinetic data. **07**

- Q.2** (a) Mention different types of solid diffusion. **03**
 (b) Briefly describe the differential method of analysis of data. **04**
 (c) Derive equation for material balance for single stage countercurrent leaching. **07**

OR

- (c) In an $O_2 - N_2$ gas mixture at 1 atm pressure and $25^\circ C$, 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. $D_{O_2-N_2} = 2.065 \times 10^{-5} \text{ m}^2/\text{s}$. **07**

- Q.3** (a) Explain different types of ideal reactors. **03**
 (b) Show that for a first order irreversible reaction $\ln(1/(1 - X_A)) = kt$. **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) Explain with the help of a graph that how activation energy affects temperature sensitivity of reaction. **03**
 (b) State Fick's first law of diffusion and explain flux N_A and J_A . **04**
 (c) Discuss different types of equilibrium diagram for leaching. **07**

- Q.4** (a) Define rate of reactions in different useful ways. **03**
 (b) Derive performance equation for an ideal batch reactor. **04**
 (c) The rate constant of a reaction is measured at different temperatures is reported below. Calculate the activation energy and frequency factor for this reaction. **07**

Temperature, $^\circ C$	20	25	30	35
Rate constant, k, min^{-1}	1.5×10^{-3}	2.67×10^{-3}	4.64×10^{-3}	7.93×10^{-3}

OR

- Q.4** (a) Explain concept of effective diffusivity for multicomponent mixtures. **03**
 (b) Define Molecular and eddy diffusion with examples. **04**
 (c) For a given liquid flow rate, give step wise procedure to calculate minimum liquid to gas ratio for absorbers. **07**

- Q.5** (a) Write about estimation of diffusivity of liquids. **03**

- (b) Explain criteria of solvent selection for gas absorption. **04**
(c) Explain classification of mass transfer operations with examples of each. **07**

OR

- Q.5** (a) Define F type and k type mass transfer coefficients. **03**
(b) State common principles of equilibrium in case of interphase mass transfer. **04**
(c) Which are different theories explaining the meaning of mass transfer coefficients? **07**
Explain Film theory in detail.
