

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-V(NEW) EXAMINATION – SUMMER 2022****Subject Code:3150405****Date:07/06/2022****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) Explain various ideal reactors with their characteristics. **03**  
 (b) State Fick's first law of diffusion and explain flux  $N_A$  and  $J_A$ . **04**  
 (c) Discuss the system of three liquids – one pair partially soluble on ternary equilibria for liquid-liquid extraction. **07**

- Q.2** (a) Define and explain the following terms: **03**  
 i) activation energy ii) elementary reactions iii) order of reaction  
 (b) Explain the criteria of solvent selection for gas absorption. **04**  
 (c) Determine the activation energy and frequency factor from the following data for the bimolecular formation of methyl ethyl ether. Also find the rate equation. **07**

Temperature, °C	0	6	12	18	24	30
$k \times 10^5$ , lit/(gmol.sec)	5.6	11.8	24.5	48.8	100	208

**OR**

- (c) Explain gas phase controlled and liquid phase controlled mass transfer operations with the help of two-resistance theory of interphase mass transfer. **07**
- Q.3** (a) At 500 K, the rate of a bimolecular reaction is ten times the rate at 400 K. Find the activation energy of the reaction from Arrhenius theory. **03**  
 (b) Liquid A decomposes by first order kinetics, and in a batch reactor. 50% of A is converted in 5 minutes. How long it will take to reach to 75% conversion? **04**  
 (c) For a given liquid flow rate, give step wise procedure to calculate minimum liquid to gas ratio for absorbers. **07**

**OR**

- Q.3** (a) Define and explain the following: **03**  
 i) extract phase ii) raffinate phase iii) solvent  
 (b) Explain the classification of reactions in details with examples. **04**  
 (c) Write a short note on differential method and integral method of analysis of kinetic data. **07**

- Q.4** (a) Define and give physical significance of Reynolds No. and Prandtl No. **03**  
 (b) Derive performance equation of a PFR. **04**  
 (c) Differentiate between direct and indirect mass transfer operations. **07**

**OR**

- Q.4** (a) Mention different types of solid diffusion. **03**  
 (b) Explain temperature and pressure dependency of diffusivity of gases and liquids. **04**  
 (c) Explain classification of mass transfer operations with examples of each. **07**

- Q.5** (a) Define molecular and eddy diffusion with examples. **03**  
 (b) Discuss industrial applications of liquid-liquid extraction. **04**  
 (c) Explain preparation of solids for leaching. **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) Derive equation for material balance for single stage countercurrent leaching. **07**

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