

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER-V (NEW) EXAMINATION – WINTER 2020
Subject Code:3150405
Date:29/01/2021
Subject Name:Chemical Engineering Fundamentals II
Time:10:30 AM TO 12:30 PM
Total Marks: 56
Instructions:

1. Attempt any FOUR questions out of EIGHT questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Define Molecular and eddy diffusion with examples. **03**
 (b) Explain criteria of solvent selection for gas absorption. **04**
 (c) Differentiate between Direct and Indirect mass transfer operations. **07**
- Q.2** (a) Define the following terms: **03**
 i) order of reaction (ii) elementary and non-elementary reactions
 (b) Explain temperature and pressure dependency of diffusivity of gases and liquids **04**
 (c) For a given liquid flow rate give step wise procedure to calculate minimum liquid to gas ratio for absorbers. **07**
- Q.3** (a) Define rate of reactions in different useful ways. **03**
 (b) Derive performance equation for an ideal batch reactor. **04**
 (c) Derive equation for material balance for single stage countercurrent leaching. **07**
- Q.4** (a) Define various k-type mass transfer coefficients along with formula and units **03**
 (b) Define and give physical significance of Reynolds No. and Prandtl No. **04**
 (c) State different theories explaining the meaning of mass transfer coefficients. Explain any one in detail. **07**
- Q.5** (a) Discuss Molecularity. Mention the general formulae for the unit of rate constant k. **03**
 (b) Derive the performance equation of recycle plug flow reactors. **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 |
- Q.6** (a) Explain concept of effective diffusivity. **03**
 (b) Explain the concept of equilibrium in case of interphase mass transfer. **04**
 (c) Describe “two resistance theory” of interphase mass transfer in brief. **07**
- Q.7** (a) Explain space time, space velocity and holding time. **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 75% conversion? **04**
 (c) Write a short note on differential method and integral method of analysis of kinetic data. **07**
- Q.8** (a) Explain Fick’s law in diffusion through solids **03**
 (b) Explain industrial applications of liquid extraction. **04**
 (c) Discuss the system of three liquids – one pair partially soluble on ternary Equilibria for liquid extraction. **07**