Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 5 – EXAMINATION – SUMMER 2026

Subject Code: 3150405 **Date: 06/06/2026**

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)** Discuss local and overall mass transfer coefficients. **03**

(b) Show that for a first order irreversible reaction ln 1/(1 - XA) = kt. **04**

(c) Discuss in detail classification of mass transfer operations and explain with examples. **07**

Q.2 **(a)** Explain molecular and eddy diffusion with examples. **03**

(b) Explain Arrhenius theory of temperature dependency. **04**

(c) Derive equations to calculate rate of steady state diffusion of 'A' through non-diffusing 'B' and also for steady state equimolal counter diffusion in case of gases. **07**

OR

Q.2 **(c)** Explain counter current multiple contact, Shanks system for leaching with a neat figure. **07**

Q.3 **(a)** Define the following terms with respect to tray towers: (i) Flooding (ii) Priming (iii) Coning **03**

(b) Discuss Film theory for mass transfer coefficient. **04**

(c) Differentiate between packed tower v/s tray tower. **07**

OR

Q.3 **(a)** State Fick's first law of diffusion and explain flux NA and JA. **03**

(b) Explain the criteria of solvent selection for gas absorption. **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, ^{o}C	20	25	30	35
Rate constant, k, min^{-1}	$1.5x10^{-3}$	$2.67x10^{-3}$	$4.64x10^{-3}$	$7.93x10^{-3}$

Q.4 **(a)** With neat diagram discuss Venturi Scrubber. **03**

(b) Derive equation for material balance for single stage leaching. **04**

(c) Derive an expression to determine the kinetics by integral method for the irreversible bi-molecular elementary reaction of 2nd order of the type A+B → P, $-r_A = kC_AC_B$. **07**

OR

Q.4 **(a)** Discuss the different ways in which rate of reaction can be defined. **03**

(b) Derive performance equation for CSTR. **04**

(c) Oxygen (A) is diffusing through carbon monoxide (B) under steady state condition with the carbon monoxide non-diffusing. The total pressure is 1 x 105 N/m2, and the temperature 0 oC. The partial pressure of oxygen at two planes 2 mm apart is, respectively 13000 and 6500 N/m2. The diffusivity for the mixture is 1.87x10-5 m2/s. Calculate the rate of diffusion of oxygen in kmol/sec through each square meter of the two planes. **07**

Q.5 **(a)** Explain preparation of solids for leaching. **03**

(b) Explain the mechanism of various kinds with example for non-elementary reaction. **04**

(c) Write short note on Bollman extractor with neat sketch. **07**

OR

Q.5 **(a)** Enlist the types of solid diffusion. **03**

(b) Explain minimum liquid to gas ratio for absorbers. **04**

(c) Explain type-I and type-II system for liquid- liquid extraction with neat sketch **07**

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