Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–V EXAMINATION – WINTER 2025

Subject Code:3150501 Date:19-11-2025

Subject Name: Mass Transfer Operations I

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.**

			MARKS
Q.1	**(a)**	Define: Plait point, selectivity and distribution coefficient in liquidliquid extraction	**03**
	(b)	Discuss the factors affecting choice of separation method	**04**
	(c)	Discuss in detail about Steady State Cocurrent processes	**07**
Q.2	**(a)**	Explain mass transfer operation between two immiscible phases	**03**
	(b)	Deduce an equation for molar flux for diffusion of component A through non-diffusing component B in case of steady state molecular diffusion for liquid phase	**04**
	(c)	With neat sketch, explain spray tower and sparged vessel as G-L equipment in brief.	**07**
		OR	
	(c)	Explain the following terms with respect to tray towers: (i) Flooding (ii)Priming (iii) Coning (iv)Weeping (v) Dumping (vi)Tray Spacing (vii)Theoretical Tray	**07**
Q.3	**(a)**	Compare N type flux and J type flux.	**03**
	(b)	Compare Penetration theory with surface renewal theory with reference to molecular diffusion	**04**
	(c)	Methane diffuses at steady state through a tube containing helium for the case equimolar counter diffusion. At point 1, the partial pressure of methane is 55 kPa and at point 2, 0.03 m apart is 15 kPa. The total pressure is 101.325 kPa and temperature is 298 k, at this temperature and pressure the value of diffusivity is 6.75×10^{-5} m^2 /s. Calculate the partial pressure of methane at point 0.02 m apart from point 1 for the above case	**07**
		OR	
Q.3	**(a)**	Explain mass, heat and momentum transfer analogies.	**03**
	(b)	Classify gas-liquid mass transfer operations with principle.	**04**
	(c)	Oxygen (A) is diffusing through carbon monoxide (B) under steady state condition with carbon monoxide non-diffusing. The total pressure is 1×10^5 N/m^2 and temperature is 0^0C. The partial pressure of oxygen at two planes 2.0 mm apart is respectively 13000 and 6500 N/m^2. The diffusivity for the mixture is 1.87×10^{-5} m^2 /s. Calculate the rate of diffusion of oxygen in kmol/s through each square meter of the two planes	**07**
Q.4	**(a)**	Define the following terms with respect to tray tower a) Priming b) Coning c) Weeping	**03**
	(b)	Explain the characteristics of fill for packed tower	**04**
	(c)	Explain “two resistance theory” briefly	**07**

OR

Q.4	**(a)**	Define the following terms with respect to tray tower a) Flooding b) Dumping c) Tray Spacing	**03**
	(b)	Explain mass, heat and momentum transfer analogies	**04**
	(c)	Explain the prevention of vortex formation in mechanically agitated vessel.	**07**
Q.5	**(a)**	Define: a) Absorption factor b) Crystallization c) selectivity of solvent	**03**
	(b)	Explain Meir's super saturation theory of crystallization.	**04**
	(c)	Explain Ternary liquid- liquid equilibrium and tie line	**07**

OR

Q.5	**(a)**	Define: a) Recoverability of solvent b) absorption c) striping	**03**
	(b)	Define super saturation and explain Meir's super saturation theory. Explain stages of crystallization. Explain stages or mechanism of crystallization.	**04**
	(c)	Discuss the system of three liquids- one pair partially soluble and the effect of temperature on ternary equilibria.	**07**

****