Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V • EXAMINATION – WINTER 2013

Subject Code: 153502 **Date: 29-11-2013**

Subject Name: Basics of Mass Transfer

Time: 10:30 pm 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.**

Q.1	**(a)**	State dimensions and SI units of viscosity, heat capacity, and molar flux. Convert 1 centipoise, 1 cal/g ^{0}C, and 1 mol/cm^2 s to corresponding SI units.	**07**
	(b)	What is Fick's law of diffusion? Derive an integrated equation to compute the molar flux of gas A diffusing through gas B in equimolar counterdiffusion.	**07**
Q.2	**(a)**	Define humidity, percentage relative humidity, humid heat, and dew point with pertinent equations.	**07**
	(b)	Define liquid extraction. What are different stages in the process of liquid extraction? Draw a schematic diagram to explain these stages. Explain binodal solubility curve.	**07**
		OR	
	(b)	Define leaching and give at least two industrial applications of the process. Describe the effect of various factors on the rate of leaching. Explain the terms overflow and underflow.	**07**
Q.3	**(a)**	With the help of neat diagrams describe horizontal tube and vertical tube natural circulation evaporators.	**07**
	(b)	Describe the process of binary distillation with the help of a T-xy diagram.	**07**
		OR	
Q.3	**(a)**	What do you mean by single effect evaporator? Write mass and heat balance equations for a single effect evaporator.	**07**
	(b)	Define the term relative volatility (α) and hence derive the following equation for a binary system $y = \frac{\alpha x_A}{1 + (\alpha - 1)x_A}$	**07**
Q.4	**(a)**	Write Henry's law and Raoult's law. Derive a relation between individual and overall mass transfer coefficients according to two film theory.	**07**
	(b)	Describe flash distillation with the help of a neat diagram. What is the importance of reflux ratio in fractional distillation?	**07**
		OR	
Q.4	**(a)**	What are bound, unbound, critical, and equilibrium moisture contents of a solid?	**07**
	(b)	Describe with a schematic diagram circulating-magma vacuum crystallizer.	**07**
Q.5	**(a)**	Describe with a diagram drying curve.	**07**
	(b)	Describe with a schematic diagram circulating-liquid evaporator crystallizer.	**07**
		OR	
Q.5	**(a)**	What are the advantages of membrane separation processes? Give any three membrane separation processes and mention their driving forces.	**07**
	(b)	With the help of two film theory explain the phenomena of mass transfer with a moderately fast chemical reaction. Draw appropriate diagram.	**07**

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