Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V • EXAMINATION – WINTER • 2014

Subject Code: 153502 **Date: 28-11-2014**

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 enthalpy, pressure, molar flux. Convert 1 atm., 1 cal/hr, and 1 gm/cm^3 to corresponding SI units.	**07**
	(b)	Define the following terms : (1) Relative volatility (2) critical moisture content (3) nucleation (4) wet-bulb temperature (5) vapor pressure (6) absolute humidity (7) partial pressure	**07**
Q.2	**(a)**	Starting from Fick's law of diffusion, derive an integrated equation to compute the molar flux of gas A diffusing through non-diffusing gas B. A and B are ideal gases.	**07**
	(b)	Draw the neat sketch of agitated vessel for gas absorption and write its construction and functioning.	**07**
		OR	
	(b)	Write in brief construction and working of drum dryer.	**07**
Q.3	**(a)**	Write principle of membrane separation. Explain in brief electro dialysis with neat sketch.	**07**
	(b)	With neat sketch explain construction and working of vacuum crystallizer.	**07**
		OR	
Q.3	**(a)**	Describe with a schematic diagram Induced draft cooling tower.	**07**
	(b)	Give importance of drying operation. Describe with diagram drying curve.	**07**
Q.4	**(a)**	Derive a relation between individual and overall mass transfer coefficients according to two film theory.	**07**
	(b)	Draw a neat schematic diagram of backward feed triple effect evaporator?	**07**
		OR	
Q.4	**(a)**	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**
	(b)	Derive Rayleigh equation for batch distillation.	**07**
Q.5	**(a)**	Calculate the equilibrium compositions of the liquid and the vapor phases for a mixture of methanol and water at a temperature of 323 K and under a pressure of 40 kPa. Vapor pressure of methanol and water at 323 K is 53.32 kPa and 12.33 kPa respectively.	**07**
	(b)	In Oxygen – nitrogen gas mixture at 101.325 kPa and 25°C, the concentrations of oxygen at two phases 2 mm apart are 10% and 20% by volume respectively. Calculate the flux of diffusion of oxygen for the cases of equimolar counter diffusion of the two gases. Diffusivity of oxygen in nitrogen is $1.18*10^{-5}$ m^2/s. R = 8.314 m^3 kpa/kmol K.	**07**
		OR	
Q.5	**(a)**	A wet solid is to be dried from 35% to 10% moisture under the constant drying conditions in five hours. If the equilibrium moisture content is 4% and the critical moisture content is 14 %, how long it takes to dry solids to 6% moisture under the same conditions?	**07**

(b) Calculate the rate of diffusion of acetic acid (A) across a film of non-diffusing water (B) 1mm thick at 290 K if the concentrations of acetic acid on the opposite sides of the film are 9% and 3% respectively. The densities of 9% and 3% solutions are 1012 kg/m^3 and 1003.2 kg/m^3 respectively. The diffusivity of acetic acid in water is $0.95*10^{-9}$ m^2/s. **07**

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