

GUJARAT TECHNOLOGICAL UNIVERSITY**B.E. Sem-Vth Examination December 2010****Subject code: 150501****Subject Name: Mass Transfer Operation - I****Date: 13 /12 /2010****Time: 03.00 pm - 05.30 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)** A 25% of dioxane in water is to be continuously extracted at a rate of 1000 kg / h in countercurrent fashion with benzene to remove 95% of the dioxane. Equilibrium data are given below. Calculate the solvent requirement for single batch Operation. At the given concentration, water and benzene are substantially insoluble. **07**

Wt % of dioxane in water	5.1	18.9	25.2
Wt % of dioxane in benzene	5.2	22.5	

- (b)** For the above problem IF 900 kg / h of solvent is used, how many theoretical stages are required? **07**
- Q.2 (a)** Discuss the minimum solvent required for Extraction in detail. **07**
- (b)** Write a Short note on Super saturation for Crystallization. **07**

OR

- (b)** Discuss in detail the Continuous Vacuum Crystallizer. **07**
- Q.3 (a)** Hydrochloric acid (A) at 283 K diffuses through thin film water (B) 4 mm thick. The concentration of A at location 1 on one boundary of the film is 12Wt % and on other boundary, at location 2 is 4 Wt %. The diffusivity of HCl in water is $2.5 \times 10^{-9} \text{ m}^2 / \text{s}$. Calculate the flux of diffusion of A assuming water to be stagnant. Density at location 1 = 1060.7 kg / m³ Density at location 2 = 1020.15 kg / m³ **07**
- (b)** Explain Penetration theory for mass transfer co-efficient. **07**

OR

- Q.3 (a)** State and Explain Fick's law of diffusion? Derive the expression for steady state equimolar diffusion of A in B. **07**
- (b)** Write in brief a type of packing's used for packed tower. **07**
- Q.4 (a)** An air – ammonia mixture containing 5% ammonia by volume is absorbed in water in a packed column operated at 293 K and 101.325 kPa so as to recover 98% ammonia. If the inert gas mass velocity to column is 1200 kg / (m² h). Calculate the mass velocity of water to this column if column is operated at 1.25 times the minimum liquid rate to column. Also calculate the composition of liquid leaving column corresponding to this condition. The Equilibrium relationship to this condition is $y = 1.154 x$. **07**
- (b)** Discuss the criteria for selection of solvent for gas absorption. **07**

OR

- Q.4 (a)** Give stepwise procedure to determine Minimum Liquid gas ratio for absorbers. **07**
- (b)** Discuss classification of mass transfer operation in detail. **07**
- Q.5 (a)** Discuss the different types of equilibrium diagrams for leaching. **07**
- (b)** Discuss the criteria of selection between tray tower and packed tower considering all unit operations. **07**

OR

- Q.5 (a)** Explain the stepwise graphical methods for calculating the no of stages for a multistage counter current leaching. **07**
- (b)** Name the equipments used in leaching Discuss any one in detail. **07**
