Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V • EXAMINATION – WINTER 2013

Subject Code: 150501 **Date: 27-11-2013**

Subject Name: Mass Transfer Operation - I

Time: 10.30 am - 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 and Explain Fick's law of diffusion. **07**

(b) In an oxygen- Nitrogen mixture at 10 atmosphere and 25^0C , the concentrations of oxygen at two places of 0.2 cm apart are 10 and 20 volume percent respectively. Calculate the rate of diffusion of oxygen expressed as gm/cm^2hr for the case of unicomponent diffusion(nitrogen non-diffusing). Value of Diffusivity is 0.181 cm^2/sec. **07**

Q.2 **(a)** With the help of diagrams show various internals of Absorption Tower. **07**

(b) 5000 kg/hr of a SO_2-air mixture containing 5% by volume SO_2 is to be scrubbed with 200,000 kg/hr of water in a packed tower. The exit concentration of SO_2 is reduced to 0.15 %. The tower operates at 1atm.The equilibrium relationship is given by

$Y = 30 X$

X,Y are mole ratio.

If the height of transfer unit is 81 cm, what is the ht. of tower ?

OR

(b) Discuss the method of estimation of Diffusivities of gases or Liquids. **07**

Q.3 **(a)** Discuss unsteady state diffusion in solids. **07**

(b) Discuss construction and working of sparged vessel. **07**

OR

Q.3 **(a)** With the help of diagram explain construction and working of Ballman Extractor used for leaching. **07**

(b) What are the criteria for choosing solvent for extraction operation. **07**

Q.4 **(a)** Draw the diagram of two consecutive Sieve trays and explain how the vapor and liquid flow occur. **07**

(b) Compare Packed column with Raschig rings and structured packing. **07**

OR

Q.4 Vegetable oil seeds containing 100 gm insoluble solid and 10 gm oil are contacted with 200 gm of organic solvent in a single stage leaching operation. The solvent used is fresh. Determine the amount of oil left in the oil seeds after leaching. The equilibrium data can be expressed as **14**

$N = - 4 y + 8$

Where, N = gm insoluble/ (gm solvent + gm oil)

y = gm oil/ (gm solvent + gm oil) in seed phase

x =gm oil/ (gm solvent + gm oil) in a solvent phase

The Tie line data are:

x	0.26	0.28	0.31	0.34
y	0.02	0.04	0.06	0.08

Q.5 **(a)** Compare surface renewal and Penetration theories. **07**

	(b)	Discus application of Wetted wall column.	**07**
		OR	
Q.5	**(a)**	Discuss construction and working of any one extractor used for liquid- liquid extraction.	**07**
	(b)	Discuss method of preparing solids for leaching.	**07**

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