

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°C , 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 $\text{gm}/\text{cm}^2\text{hr}$ for the case of unicomponent diffusion(nitrogen non-diffusing). Value of Diffusivity is $0.181 \text{ cm}^2/\text{sec}$. **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

$$Y = 30 X$$

$$X, Y \text{ are mole ratio.}$$
 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

$$N = -4y + 8$$
 Where, $N = \text{gm insoluble} / (\text{gm solvent} + \text{gm oil})$
 $y = \text{gm oil} / (\text{gm solvent} + \text{gm oil}) \text{ in seed phase}$
 $x = \text{gm oil} / (\text{gm solvent} + \text{gm oil}) \text{ in a solvent phase}$
 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) Discuss 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**
