

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V • EXAMINATION – SUMMER • 2014

Subject Code: 153502

Date: 13-06-2014

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 diffusivity, concentration gradient, and molar flux. Convert $1 \text{ cm}^2/\text{s}$, $1 (\text{mol/l})/(\text{cm})$, and $1 \text{ mol}/\text{cm}^2 \text{ s}$ to corresponding SI units. **07**
- (b) 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**
- Q.2** (a) Explain wet bulb temperature and adiabatic saturation temperature. **07**
- (b) When is the operation liquid extraction used in chemical process industry? Explain binodal solubility curve taking suitable example of a ternary system. **07**
- OR**
- (b) What are various factors influencing the rate of leaching? Describe their effect on leaching process. Explain the terms overflow and underflow. **07**
- Q.3** (a) Compare and contrast horizontal tube and vertical tube natural circulation evaporators. **07**
- (b) What are MVC and LVC in distillation? On what principle is distillation operation based? How is equilibrium data expressed in distillation? **07**
- OR**
- Q.3** (a) Draw a neat schematic diagram of forward feed triple effect evaporator? **07**
- (b) Define the term relative volatility (α) and hence derive the following equation for a binary system **07**
- $$y = \frac{\alpha x_A}{1 + (\alpha - 1)x_A}$$
- Q.4** (a) Derive a relation between individual and overall mass transfer coefficients according to two film theory. **07**
- (b) Describe fractional distillation with the help of a neat diagram. What is reflux ratio? **07**
- OR**
- Q.4** (a) Show on a drying curve free, critical, and equilibrium moisture contents of a solid? **07**
- (b) Describe with a schematic diagram circulating-magma vacuum crystallizer. **07**
- Q.5** (a) Draw a schematic diagram of tray type gas absorption column and describe the process. **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) Draw a schematic diagram of packed bed gas absorption column and described the process. **07**
