



(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 182603

Roll No.

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B. Tech.

(SEM. VI) THEORY EXAMINATION, 2014-15
MASS TRANSFER OPERATIONS

Time : 3 Hours]

[Total Marks : 100

Note: (1) Attempt ALL questions.

(2) Assume suitable data, if required.

(3) Be precise in your answer

(4) All questions carry equal marks

1 Attempt any FOUR parts of the following:- (5×4=20)

(a) Explain Azeotropic distillation with suitable examples.

(b) Classify the mass transfer operations with suitable examples.

(c) Explain P-x-y phase diagram.

(d) Write a short note on 'Design equations for packed column'.

(e) What is the role of mass transfer coefficient in mass transfer process?

(f) Explain 'Molecular diffusion in fluids' with suitable example.

- 2 Attempt any TWO parts of the following: (10×2=20)
- (a) What is Henry's law? Differentiate between McCabe Thiele Method and Ponchon savarit Method for the determination of number of theoretical plates in the rectification column.
 - (b) What are the different conditions of the feed streams to a distillation column? Also derive the equation of feed line.
 - (c) A material is dried under constant drying conditions and it was found that 3 hours are required to reduce the free moisture contents from 20% to 10%. How much time is required to reduce the free moisture to 5%. Assume that no constant rate period is encountered.
- 3 Attempt any TWO parts of the following : (10×2=20)
- (a) Ammonia is to be removed from its mixture with air by scrubbing with water in a packed tower. A gas mixture entering the column contains 8% NH_3 volume and 92% air volume. Water enters the column counter current direction. If 90% of ammonia is to be removed water at the rate of 2 moles water per mole of air. Determine the exit concentration of ammonia. The gas liquid equilibrium relationship is $y = 0.08x$, where y = moles of NH_3 /moles of air, x = moles of NH_3 /moles of water.
 - (b) Explain the construction and operation of 'Rotary Driers' with the help of neat sketch.
 - (c) For dilute mixture and cases where Henry's law ($y^* = mx$) applies, prove that the number of overall gas phase transfer units for countercurrent gas absorption in packed tower is given by

$$NTU_{OG} = \frac{\ln \left[\frac{y_1 - mx_2}{y_2 - mx_2} \left(1 - \frac{1}{A} \right) + \frac{1}{A} \right]}{1 - \frac{1}{A}}$$

Where subscript 1 indicates bottom (where gas enters the liquid leaves), subscript 2 indicates the top of the tower and A is absorption factor.

4 Attempt any TWO parts of the following:- (10×2=20)

- (a) Differentiate between Batch and continuous drying. Explain the method by which you can calculate the rate of batch drying.
- (b) The gas having 0.025 moles/mole dry gas of impurities is to be cleaned to remove 95% of the impurities by using a pure solvent. Determine G/L ratio and required number of ideal plates. The solvent leaving the column contains 0.002 moles/mole solvent. The equilibrium data are:

<i>x</i>	0.0121	0.0341	0.0812	0.1364	0.1990	0.2658
<i>y</i>	0.0013	0.0036	0.0083	0.0134	0.0186	0.0236

- (c) Describe 'Multistage solvent Extraction' in detail, with the suitable example.

5 Write short notes on any FOUR parts of the following: $5 \times 4 = 20$

- (a) Bubble point
 - (b) HETP
 - (c) Surface diffusion
 - (d) Relative volatility
 - (e) Dry bulb temperature
 - (f) Entrainment & Flooding.
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