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Total Number of Pages : 02

B.Tech.
PCCH4302

5th Semester Back Examination 2017-18

Mass Transfer - I

BRANCH : CHEM

Time : 3 Hours

Max Marks : 70

Question Code : B213

Answer Question No. 1 which is compulsory and any FIVE from the rest.

The figures in the right-hand margin indicate marks.

Assume suitable notations and any missing data wherever necessary.

Answer all parts of a question at a place.

Q1 Answer the following questions : **(2 x 10)**

- (a) Write the Gilliland's equation and explain various terms used.
- (b) Write and explain Fick's first law of diffusion.
- (c) What type of towers are suitable for corrosive and foamy liquids ?
- (d) When is steam distillation recommended ?
- (e) What do you understand by absorption factor ?
- (f) Mention the characteristics of a good absorbent.
- (g) What do you understand by Reynolds analogy ?
- (h) Define relative volatility and discuss its importance.
- (i) Define dry bulb, wet bulb, dew point, and adiabatic saturation temperatures.
- (j) Differentiate between azeotropic and extractive distillation.

Q2 Derive the Stefan's method for the determination of diffusivity with a neat sketch. **(10)**

Q3 Discuss in detail the two-film theory for mass transfer. **(10)**

Q4 Discuss the concept of VLE for binary systems with a neat PTxy diagram. Also discuss the effect of T on Pxy diagram. **(10)**

Q5 A mixture of SO₂-air containing 6% by volume SO₂ at 4500 kg/hr is scrubbed with 150,000 kg/hr of water in a packed tower. The exit concentration of SO₂ is reduced to 1.5%. The tower operates at 1 atm pressure. The equilibrium relationship is given by: $Y = 30 X$, where $Y = \text{mole SO}_2 / \text{mole air}$ and $X = \text{mole SO}_2 / \text{mole water}$. If the packed height of the tower is 500 cm, estimate the height of transfer unit. **(10)**

Q6

A liquid mixture containing 50 mol % heptane (A) and 50 mol % octane (B), is to be continuously flash vaporized at 1 atm pressure to vaporize 60 mol % of the feed. What will be the composition of the vapour and liquid in the separator for an equilibrium stage ?

Data:

T ($^{\circ}$ C)	98.5	105	110	115	120	125.5
Vapour pressure of A (mm Hg)	760	940	1050	1200	1350	1540
Vapour pressure of B (mm Hg)	333	417	484	561	650	760

(10)

Q7

Discuss in detail with a neat sketch the construction and operation of a bubble-cap distillation column.

(10)

Q8

Write short notes on any TWO :

(5 x 2)

- (a) Surface-renewal theories
- (b) Optimum reflux ratio
- (c) Spray ponds and spray towers
- (d) Sling psychrometer