

Code No: 56103

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, April - 2018

MASS TRANSFER OPERATIONS

(Petroleum Engineering)

Time: 3 hours

Max. Marks: 75

Answer any five questions  
All questions carry equal marks

- - -

- 1.a) Discuss the estimation of diffusivity of gases and liquids  
b) Calculate the rate of diffusion of CO<sub>2</sub> through a membrane of vulcanized rubber 5 mm thick at 298 K, if the partial pressure of CO<sub>2</sub> is 5 cm Hg on one side and zero on the other. Also calculate the permeability of the membrane for CO<sub>2</sub>. At 298 K the solubility coefficient of CO<sub>2</sub> is 0.9 m<sup>3</sup> gas (STP)/m<sup>3</sup>. atm. The diffusivity of CO<sub>2</sub> is 1.1×10<sup>-10</sup> m<sup>2</sup>/s. [7+8]
- 2.a) With a neat figure explain the following two theories:  
i) Combination Film-Surface-renewal theory  
ii) Surface-Stretch Theory  
b) Explain the two resistance theory with neat diagram. [8+7]
- 3.a) Compare the packed towers and tray towers.  
b) Write short notes on Liquid Dispersed Venturi Scrubbers. [8+7]
- 4.a) Write short notes on:  
i) Flash vaporization  
ii) Steam distillation.  
b) Ammonia is absorbed from a gas by water in a scrubber under atmospheric pressure. The initial ammonia content in the gas is 0.04 kmol/kmol of inert gas. The recovery of ammonia by absorption is 90%. The water enters the tower free from ammonia. Estimate (i) Concentration of ammonia in the exiting liquid if the actual water used is 1.5 times minimum. (ii) Number of theoretical stages required.

X	0.005	0.01	0.0125	0.015	0.02	0.023
Y	0.0045	0.0102	0.0138	0.0183	0.0273	0.0327

Where X and Y are mole ratios.

[7+8]

- 5.a) Compare and contrast Azeotropic and extractive distillation.  
b) Explain how to estimate total reflux, minimum and optimum reflux ratios. [7+8]
- 6.a) What is Liquid-Liquid Extraction (LLE) process? Explain the types of equilibrium system briefly.  
b) Discuss the Multi stage cross and counter current operations with a neat flow diagram. [7+8]

7.a) Explain briefly the Adsorption Hysteresis and Adsorption isotherm.

b) Write short notes on:

i) Pressure and thermal swing adsorption

ii) Fixed bed adsorption.

[7+8]

8.a) Define Pervaporation? What is the main driving force for mass transport? Explain briefly concentration polarization.

b) What is Osmosis? Explain the principle of operation of Reverse Osmosis (RO) with a neat diagram.

[7+8]

---ooOoo---

Used paper 27-04-2018