R09

Code No: 54047

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, December - 2017
MASS TRANSFER OPERATIONS
(Biotechnology)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
- - -

1.a) Ammonia gas (A) diffuses through nitrogen gas (B) under steady state conditions with nitrogen non diffusing. The total pressure is 1.013×10^5 pa and the temperature is 298 K. The diffusion path (z_2-z_1) is 0.15 m. The partial pressure of NH_3 at one point is 1.5×10^4 Pa. The D_{AB} of the mixture at 1.013×10^5 pa and 298 K is 2.3×10^{-5} m^2/sec. Calculate the flux of NH_3.

b) Derive Stefan's equation for the estimation of diffusion coefficient. [8+7]

2.a) Describe the effect of gas velocity on the mass transfer rate in fermentation broths.

b) List various ways of expressing mass transfer coefficient with their units. [7+8]

3.a) A vapour mixture containing 70-mole% methanol and the rest water vapour is condensed differentially at 760 mm Hg, to condense 60% of the feed. Compute the composition of the vaporous residue and the condensate. The equilibrium data is given below:

"X"	0.1	0.2	0.4	0.6	0.8	1.0
"Y"	0.417	0.519	0.729	0.825	0.915	1.0

b) Explain briefly about the estimation of number of stages by Mecabe-Thiele Method. [8+7]

4.a) What are the important characteristics of a good solvent in liquid-liquid extraction?

b) One hundred kilograms of a 50% solution of C in A (carrier) is equilibrated with 70 kg of solvent B containing 2% of C. At equilibrium, the raffinate phase has a mass of 80 kg and has 52% A and 8% B in it. What is the selectivity?

c) Write short notes on applications of liquid-liquid extraction. [7+4+4]

5.a) Discuss the mechanism of leaching and the factors which will influence the rate of leaching.

b) What is the rate of nucleation? Explain attrition and origins of crystal in crystallizers. [7+8]

6. 1400 kg (bone dry) of granular solid is to be dried under constant drying conditions from moisture content of 0.2 kg/kg of dry solid to a final moisture content of 0.02 kg/kg dry solid. The material has an effective area of 0.0615 m^2 /kg of solid. Under the same condition the following rates were previously known (data given below). Calculate the time required for drying.

X:	0.300	0.200	0.140	0.096	0.056	0.046	0.026	0.016
N:	1.710	1.710	1.710	1.460	1.290	0.880	0.540	0.376

Where X is kg/kg of dry solid and N is in kg/ m^2. [15]

7.a) What are the six most common membrane separation processes? Give an industrial application of each one.

b) Write the equations for calculating water flux, solute flux and rejection coefficient in reverse osmosis process. [8+7]

8.a) Address the problems encountered during recovery of ethanol and the requirements to overcome these difficulties.

b) Explain briefly the extraction of penicillin using butyl acetate solvent. [10+5]

---ooOoo---