QPC: RJ20MTECH023 AR 19 Reg. No

GIET UNIVERSITY, GUNUPUR – 765022

M. Tech (First Semester – Regular) Examinations, June – 2021

MPCCH1020 – ADVANCED MASS TRANSFER

(Chemical Engineering)

Time: 2 hrs Maximum: 50 Marks

The figures in the right hand margin indicate marks.

PART – A **(2 x 10 = 20 Marks)**

Q1. Answer **ALL** questions

a. Write the material and energy balance for the single stage flash vaporization with rough sketch?
b. Explain eddy diffusion and molecular diffusion?
c. Derive the governing equations for differential distillation of binary mixture
d. Write four industrial applications of leaching?
e. Explain pressure-swing distillation
f. Define stage efficiency and Murphree stage efficiency for 'E' and 'R' Phase?
g. Explain the pinch point using schematic? What are the effects of the pinch point on the tray tower column?
h. Explain how the pressure drop in packed towers is calculated?
i. Write and explain the terms in Maxwell-Stefan equation?
j. Write how Ponchon–Savarit graphical method is different from the McCabe– Thiele method

PART – B **(6 x 5 = 30 Marks)**

Answer ***ANY FIVE*** questions **Marks**

2. Derive Rachford- Rice equation for flash process 6
3. Explain how the Maxwell–Stefan difference equations related to Fick's law 6
4. A flue gas containing 15% CO_2 and rest O_2 and N_2 by volume is scrubbed in a tray tower at 1.2 atm and 25 ^{0}C with ethanolamine solution. The equilibrium data for the system is given below: 6

Moles of CO_2 per mole of solution (X)	0.058	0.06	0.062	0.064	0.066	0.068	0.07
Partial Pressure of CO_2, mm Hg	5.6	12.8	29	56	98.7	155	232

The scrubbing liquid contains 0.058 moles CO_2 per mole of solution and gas leaving the scrubber contains 2% by vol. of CO_2. Determine the number of theoretical stages required for 1.5 times the minimum ratio.

5. Explain two-film theory of mass transfer using the rough sketch of interface 6
6. Explain the graphical method to evaluate stages using Ponchon–Savarit method using schematics 6
7. Explain the working of packed tower column using schematic? Outline various packing materials that can be used in the packed tower? 6
8. In the absorption of ammonia into water from an air-ammonia mixture at 300K and 1.2 atm, the individual film coefficient is estimated to be 6

k_G = 1.17 kmol/m^2-h-atm. The equilibrium relationship for very dilute solutions of ammonia in water at 300K and 1.2 atm is

$$p_{A,i} = 1.64\, x_{A,i}$$

At one point in the equipment, the mixture contains 24 mole % ammonia and liquid contains 6 mole% ammonia. And 45 % of the resistance is in the gas film

(a) The overall mass transfer coefficient, K_y in kmol/(s.m^2)

(b) The molar flux of A, $N_A$in kmol/m^2.s

(c) Calculate the film coefficient, k_x

(d) The concentration on the liquid side of the interface, $x_{A,i}$

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