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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2018

Programme: M.Tech. Chem Engg (with spl in PDE)

Semester – II

Course Name: Mass Transfer Equipment Design and Separation Processes

Max. Marks : 100

Course Code: CHPD 7010

Duration : 3 Hrs

No. of page/s: 02

Note: Assume suitable data, if necessary.

Section A

Answer all questions. Each carries 12 marks. [12X5=60 Marks]

Q.1 Describe with example, 'Extractive Distillation'. [12]

Q.2 Elaborate on "Minimum Liquid-Gas Ratio for Absorbers". Diagrams are necessary. [12]

Q.3 Discuss 'Choice of Solvent for Liquid-Liquid Extraction' with regard to selectivity, distribution coefficient and recoverability. [12]

Q.4 100 kg of a solution of acetic acid(C) and water (A) containing 30 wt% acid is to be extracted with 150 kg of fresh isopropyl ether (B) at 20°C, in a single stage cross-current extraction. Determine the quantities of extract and raffinate if the equilibrium concentration of raffinate is 25.5 wt% acetic acid. [12]

The equilibrium tie line data at 20°C are as follows:

Water layer			Isopropyl ether layer		
Wt % acetic acid, 100x	Water	Isopropyl ether	Acetic acid, 100y*	Water	Isopropyl ether
0.69	98.1	1.2	0.18	0.5	99.3
1.41	97.1	1.5	0.37	0.7	98.9
2.89	95.5	1.6	0.79	0.8	98.4
6.42	91.7	1.9	1.93	1.0	97.1
13.30	84.4	2.3	4.82	1.9	93.3
25.50	71.1	3.4	11.40	3.9	84.7
36.70	58.9	4.4	21.60	6.9	71.5
44.30	45.1	10.6	31.10	10.8	58.1
46.40	37.1	16.5	36.20	15.1	48.7

Q.5 Describe with sketch, simulation of moving beds for adsorption. [12]

Section B

Q.6 is compulsory. Out of Q.7 and 8 answer any one question. [30+10= 40 Marks]

Q.6 An aqueous solution is colored by small amounts of an impurity. It is desired to reduce the color by adsorption. Initial concentration of color is 9.6 units of color / kg solution. Determine the total quantity of fresh carbon required per 1000 kg of solution for a two-stage crosscurrent adsorption, if the slopes of the first and second stage operating lines are -11.14×10^{-3} and -8.67×10^{-3} respectively. Assume equilibrium condition for each stage. What will be the concentration of color (units/kg solution) at the end of each stage? [30]

Equilibrium data at constant temperature:

kg carbon/kg soln	0	0.001	0.004	0.008	0.02	0.04
Equilibrium color units of color/kg solution	9.6	8.6	6.3	4.3	1.7	0.7

Q.7 What is ROSE (Residuum Oil Supercritical Extraction) process? Give its advantages over conventional process. [10]

OR

Q.8 Define the terms, osmosis and reverse osmosis. Give the applications of reverse osmosis. Also give its advantages. [10]