

B. Tech-6 (Chem. Engg)

Mass Transfer-II

Full Marks : 70

Time : 3 hours

Answer all questions.

The figures in the right-hand margin indicate marks.

Symbols carry usual meaning.

1. Answer *all* questions : 2 × 10
- (a) Express Kremser equation for the continuous counter-current extraction operation.
 - (b) Write the properties of a good solvent for extraction.
 - (c) Write any two industrial applications of leaching.
 - (d) What is plait point ?
 - (e) What are the various factors which limits the rate of Solid-Liquid extraction ?

(Turn Over)

- (f) What is van der Waals adsorption ?
- (g) What are the different types of adsorption isotherms ?
- (h) What is meant by Critical moisture ?
- (i) Can the moisture content of solid on dry basis be above 100% ? Justify of answer.
- (j) Write and explain Freundlich equation.
2. Explain how you will find out the final composition of the solute in the raffinate for immiscible solvent and diluents in single and multistage cross-current extraction. 10

Or

A 2600 kg batch of pyridine-water solution, 55% pyridine is to be extracted with chlorobenzene three times and each time 2250 kg of solvent is to be used. Determine the concentration of pyridine in the final raffinate. Equilibrium tie-line data for the system water-chlorobenzene-pyridine at 25 °C are given below :

(3)

Pyridine	Chlorobenzene	Water	Pyridine	Chlorobenzene	Water
0	99.95	0.05	0	0.08	99.92
11.05	88.28	0.67	5.02	0.16	94.82
18.95	79.90	1.15	11.05	0.24	88.71
24.10	74.28	1.62	18.90	0.38	80.72
28.60	69.15	2.25	25.50	0.58	73.92
31.55	65.58	2.87	36.10	1.85	62.05
35.05	61.00	3.95	44.95	4.18	50.87
40.60	53.00	6.40	53.20	8.90	37.90
49.00	37.8	13.2	49.00	37.80	13.20

3. With a neat sketch, explain the working principle of rotocel extractor. 10

Or

500 kg/hr of mustard cake is to be extracted in a counter current cascade with ether to recover oil. The ether which has been partially purified contains 5% oil. The fresh cake contains 15% oil and is to be extracted to a composition of 2% oil (on solvent free basis). If 200 kg of solvent is to be used, What percentage of oil entering with the cake is recovered in the extract ?

4. Explain the factors affecting the rate of adsorption and break through curve in adsorption. 10

(4)

Or

Experiments on decolourization of oil yielded the equilibrium relationship is given by $Y = 0.57 X^{0.5}$ where Y is gram colour removed per gram adsorbent and X is gram colour in the oil per 1000 gram of colour-free oil. If 100 kg of oil containing 1 part of colour to 3 parts of oil is agitated with 25 kg of the adsorbent. Calculate the percentage of colour removed if all 25 kg adsorbent is used in one step.

5. Explain with neat diagram the construction details and working principles of Spary driers. 10

Or

Obtain an expression for the drying time in the case of a substance having both falling rate and constant rate drying periods.

6. Describe the Bollman extractor used in leaching operation. 10

Or

A wet solid of 28% moisture is to be dried to 0.5% moisture in a tray dryer. A laboratory test

(5)

shows that it requires 8 hours to reduce the moisture content of the same solid to 2.0%. The critical moisture content is 6% and the equilibrium moisture content is 0.2%. The falling rate of the drying is linear in the free moisture content. Calculate the drying time of the solid if the drying conditions similar to those in the laboratory test are maintained. All moisture are expressed as percent of 'bone dry' mass of the solid.
