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SARDAR PATEL UNIVERSITY
EXTERNAL EXAMINATION
M.SC. INDUSTRIAL CHEMISTRY
(FIRST SEMESTER)
PS01CICH24: MASS TRANSFER OPERATIONS
MONDAY, 9TH APRIL, 2018

Time: 10:00 am to 1:00 pm

Total Marks: 70

Q1. Answer the following multiple choice question.

(08)

- Which distillation is used to separate the high boiling mixture?
i. Azeotropic ii. Steam iii. Extractive iv. Simple
- Bubble cap columns are characterized by their ____
i. High pressure drop iii. Low pressure drop
ii. High cost iv. Low cost
- Removal of volatile components of oil by using steam is an example of ____
i. Desorption ii. Absorption iii. Drying iv. Extraction
- Selectivity of solvent used in liquid extraction should be
i. >1 ii. 0 iii. <1 iv. 1
- Corners of the equilateral triangle in the solubility curve represent
i. A pure component iii. A ternary mixture
ii. A binary mixture iv. A partially miscible ternary mixture
- Filtration is useful when
i. Only one solid is soluble ii. Both solids are soluble
iii. Solids are insoluble iv. When both liquids are miscible
- Which dryer is used to dry the milk?
i. Tray ii. Rotary iii. Spray iv. Tunnel
- In industry ____ is usually carried out at end.
i. Drying ii. Filtration iii. Crystallization iv. Evaporation

Q2. Answer any seven of following.

(14)

- State Rayleighs equation for simple distillation.
- What is channelling?
- Enlist suitable example of leaching.
- Why density and boiling point of solvent are given preference to select solvent for extraction?
- Compare multistage cross and counter extraction.
- Define selectivity in liquid-liquid extraction.
- What are filter aids?
- Define the following term:
1. Equilibrium moisture content 2. Critical moisture content
- Define hold up in rotary dryer.

C.P.T.O.)

Q-3.

- a. Derive the operating line equations for enriching and stripping section using Ponchon-Savarit method. (06)
- b. For the given system of methanol-water which is to be separated using distillation, determine the minimum reflux ratio. (06)

F=4800 kg/hr, $X_F=40\%$, $h_F=68$ Kcal/kg $X_D=97\%$ $X_W=3\%$ $h_D=52$ kcal/kg $h_W=300$ kcal/kg							
Mole fraction	0	0.2	0.4	0.6	0.8	0.9	10
Enthalpy (liquid) kcal/kg	345	185	70	11	22	40	65
Enthalpy (vapour) kcal/kg	1200	1100	1000	890	770	700	554

X	0	0.2	0.4	0.6	0.8	0.9	1
Y	0	0.7	0.9	0.95	0.98	0.99	1

OR

- b. Distinguish between plate and packed columns used in distillation. (06)

Q-4.

- a. Discuss the effect of pressure drop and flow rate on gas absorption. (06)
- b. Derive the operating line equation using material balance diagram for the packed column. (06)

OR

- b. Discuss the HETP in detail. (06)

Q-5.

- a. Describe the various points to be considered in the selection of solvents for liquid liquid extraction. (06)
- b. Enlist the steps involved in the calculation of theoretical stages in counter current extraction. (06)

OR

- b. Calculate the number of extraction stages required to separate component C from its mixture with A using cross current liquid-liquid extraction as the details shown below. (06)

F= 1000 kg/hr, $x_F=39\%$, S =350 kg/hr, $x_n=2\%$					
Extract			Raffinate		
%A	%B	%C	%A	%B	%C
0.8	85.5	12	89.8	1.5	9
5	73	25	81.4	3	20.1
6.9	58.5	33	69	5	29
10.2	50	39	59.7	8.2	39.5
18.3	42	46	40	10	41
22.2	29	49	39.6	12	44

Q-6.

- a. Discuss the rate of drying curve in detail. (06)
- b. A batch of the solid is dried from 25% to 7% moisture. The initial weight of the wet solid is 180kg and the drying surface is $1\text{m}^2/50\text{kg}$ dry weight. Determine the time require in hour for drying wet solid. (06)

X	N
0.23	0.350×10^{-3}
0.22	0.350×10^{-3}
0.21	0.350×10^{-3}
0.18	0.366×10^{-3}
0.16	0.239×10^{-3}
0.14	0.208×10^{-3}

X	N
0.12	0.180×10^{-3}
0.10	0.150×10^{-3}
0.09	0.097×10^{-3}
0.08	0.070×10^{-3}
0.07	0.043×10^{-3}
0.06	0.025×10^{-3}

OR

- b. Derive the relation between thickness of cake (l) and volume of filtrate (V) for constant rate and constant pressure filtration. (06)

← X →

DATE : _____

P.NO. : _____



