BACHELOR OF TECHNOLOGY (C.B.C.S.) (2014 COURSE)
B.Tech.Sem - VI CHEMICAL : : SUMMER - 2022
SUBJECT : SEPARATION TECHNIQUES

Day : Monday
Date : 13-06-2022

S-13508-2022

Time : 02:30 PM-05:30 PM
Max. Marks : 60

N.B.

1) All questions are **COMPULSORY**.
2) Figures to the **RIGHT** indicate **FULL** marks.
3) Use of non-programmable calculator is **allowed**.
4) Assume suitable data **WHEREVER** necessary.

Q.1 **a)** Describe positive deviation from ideality with suitable diagram. **(05)**

b) What is azeotropic distillation? Describe its industrial applications. **(05)**

OR

Q.1 An equimolar feed mixture of 100 moles containing A and B is differentially distilled such that residue contains 23% of A. Estimate the composition of distillate and residue **(10)**

X	0	1	8	14	21	29	37	46	56	66	97	100
Y	0	3	16	28	39	50	59	65	76	83	99	100

Q.2 Derive q-line equation and show that, $y=\frac{q}{q-1}x-\frac{xf}{(q-1)}$. **(10)**

OR

Q.2 It is desired to separate a mixture of 50% vapor and 50% liquid in a plate type distillation column. The feed contains 45 mole % A and the top product is to contain 96 mole % of A. **(10)**

A bottom product is to contain 5 mole % A. Determine the minimum reflux ratio and the number of theoretical plates needed if a reflux ratio of twice the minimum is used.

The equilibrium data is as below

x	0	0.1	0.16	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
y	0	0.215	0.3	0.52	0.625	0.725	0.78	0.89	0.89	0.95	1.0

x and y are the mole fractions of A in liquid and vapour phase respectively.

Q.3 Draw schematic arrangement of multistage cross current adsorption operation and write a material balance of solute for stage 1 and 2. Represent the operation graphically and describe the steps involved in the determination of no. of stages needed. **(10)**

OR

Q.3 500 Kg/min of dry air at 20^0C and carrying 5 kg of water vapor/min is to be dehumidified with silica get to obtain air with 0.001 kg of water vapour/kg of dry air. The adsorption operation has to be carried out counter-currently with 25 kg/min of dry silica gel. How many theoretical stages are required and what will be water content in the silica gel leaving the last stage? **(10)**

$\frac{kg\ of\ water\ vap}{kg\ of\ dry\ silica\ gel}$, X	0	0.05	0.10	0.15	0.20
$\frac{kg\ of\ water\ vap}{kg\ of\ dry\ air}$, Y	0	0.0018	0.0036	0.005	0.0062

PTO

Q.4 Draw a multistage cross current extraction operation for an insoluble system and make a mass balance about stage n. describe the graphical determination of no. of stages in the cross-current operation. **(10)**

OR

Q.4 1000 kg per hour of a solution of C in A containing 20% C by weight is to be counter currently extracted with 400 kg/h of solvent B. the component A and B are insoluble. **(10)**

wt. of C / wt. of A	0.05	0.20	0.3	0.45	0.5	0.54
wt. of C / wt. of B	0.25	0.4	0.5	0.65	0.7	0.74

How many theoretical stages will be required to reduce the concentration of C to 5 % in effluent?

Q.5 Describe with neat sketch different types of equilibrium diagrams encountered in leaching operation. **(10)**

OR

Q.5 Describe various steps involved in leaching operation. What factors have direct impact on the success of the leaching operation? Describe these factors in detail. **(10)**

Q.6 What are the limitations and industrial applications of i) Ultrafiltration ii) Nano-filtration? **(10)**

OR

Q.6 What is Reverse Osmosis? What are its advantages over other membrane separation processes? State its industrial applications. **(10)**

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