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

Day : Thursday | Time : 10:00 AM-01:00 PM

Date : 24-11-2022 | **W-13508-2022** | 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 constant pressure vapour liquid equilibria with a neat sketch. **(05)**

b) What is relative volatility? Describe the effect of relative volatility on the degree of separation that can be achieved using distillation. **(05)**

OR

Q.1 Compute the vapor liquid equilibrium data from the following data at 760 mm Hg pressure. Also calculate the avg. relative volatility. **(10)**

V.P. of A mm of Hg	760	830	920	1060	1200	1360
V.P. of B, mm of Hg	200	350	420	550	690	760

P_T = 760 mm of Hg.

Q.2 **a)** What are the assumptions of McCabe Thiele method? State equations of top and bottom operating line. **(05)**

b) What is reflux ratio? Describe the effect of reflux ratio on the no. of stages required for distillation operation. **(05)**

OR

Q.2 A mixture of 35 mole % of A and 65 mole % of B is to be separated in the fractionating column. The concentration of A in the distillate is 93 mole % and 96 mole % of A is recovered in the distillate. The feed is half vapor and reflux ratio is 4.0. The relative volatility of A to B is 2.0 Calculate the no. of theoretical stages in the column and locate the feed plate. **(10)**

Q.3 **a)** What is adsorption hysteresis? **(05)**

b) Describe the graphical method of determining minimum adsorbent to solvent ratio $(L_s/G_s)_{min}$ for counter current multistage adsorption operation. **(05)**

OR

Q.3 The equilibrium decolorization data for a certain system using activated carbon is given by the equation **(10)**

$Y = 0.004X^2$ where,

$$Y = \frac{gm\ of\ coloring\ impurity}{kg\ of\ impurity\ free\ solution} \qquad X = \frac{gm\ \ of\ coloring\ \ impurity}{kg\ \ of\ pure\ \ activated\ \ carbon}$$

Calculate the amount of activated carbon required per 1000 kg of impurity free solution to reduce the impurity concentration from 1.2 to 0.2 g/kg of impurity free solution using two stage cross current operation with intermediate composition of 0.5 g of coloring impurity per kg of impurity free solution.

Q.4 **a)** What is the effect of temperature and pressure on binodal solubility curve? **(05)**

b) What are the factors influencing choice of solvents for liquid–liquid extraction? **(05)**

OR

P.T.O.

Q.4 500 kg/h of an aqueous solution containing 8% acetone is to be counter-currently extracted using monochlorobenzene to reduce the acetone content to 4 % of its initial value. Water and monochlorobenzene are immiscible with each other **(10)**

i) Determine minimum solvent rate

ii) The number of theoretical stages required if 1.3 times the minimum solvent rate is used

$\frac{kg\ of\ acetone}{kg\ of\ water}$	0.030	0.074	0.161	0.210
$\frac{kg\ of\ acetone}{kg\ of\ monochlorobenzene}$	0.029	0.071	0.158	0.204

Q.5 Draw the schematic diagram of multistage counter current leaching operation and write the material balance equations. Also describe the stepwise graphical procedure to obtain the no. of stages. **(10)**

OR

Q.5 What is solid-liquid equilibrium in leaching operation? Describe various types of equilibrium diagrams with neat sketch. **(10)**

Q.6 What is Electro-dialysis? Describe with neat sketch the working principle and state its industrial applications. **(10)**

OR

Q.6 What are the various membrane separation processes? Describe the limitations and applications of these methods. **(10)**

*****