

Q.P. Code : 616100

REVISED COURSE

(3 Hours)

[Total Marks : 80]

- N.B. :** (1) Question No 1 is compulsory.
 (2) Solve any three questions out of remaining five questions.
 (3) Assume suitable data whenever required.

1. Answer the following (any four) : 20
- (a) Write a note on activated carbon as an adsorbent.
 - (b) Give methods of foam formation, coalescence and collapse.
 - (c) What are the main components of HPLC?
 - (d) What is a membrane? Give classification of membranes.
 - (e) Explain the principle of liquid chromatography and state its various types.
 - (f) Write a note on characteristics of modern adsorbents.
2. (a) Explain pressure swing adsorption (PSA) technology with appropriate example. 10
- (b) Explain the following membrane characterization techniques:- 10
- (i) Scanning electron microscope
 - (ii) Bubble point method
3. (a) Write a note on membrane fouling and explain various methods to reduce fouling. 10
- (b) An industrial wastewater contains 50 mg/L chlorophenol and is going to be treated by carbon adsorption. 95% removal is desired. The wastewater is discharged at a rate of 4×10^5 L/day. If Freundlich isotherm ($q = 6.75C^{0.41}$, where q is in mg/g) is used, calculate the carbon requirement for:- 10
- (i) A single, mixed contactor
 - (ii) Two mixed contactors in series with intermediate concentration of 25 mg/L
4. (a) Explain in brief the different modes of operation of a foam fractionation column. 10
- (b) A dialysis process is being designed to recover a certain solute from its dilute solution having solute concentration of 2.0×10^{-2} kmol/m³. The solute passes through a membrane and its concentration on the other side 10

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is $0.3 \times 10^{-2} \text{ kmol/m}^3$. The membrane is $1.59 \times 10^{-5} \text{ m}$ thick. The mass transfer coefficients upstream and downstream are $3.5 \times 10^{-5} \text{ m/s}$ respectively.

Calculate:

- (i) The permeability when flux obtained is $2.492 \times 10^{-8} \text{ kmol/(h.m}^2)$
- (ii) Diffusivity of solute when distribution coefficient is 0.75
- (iii) The individual resistances and total resistance.
- (iv) The concentrations at the membrane interfaces.

5. (a) Discuss the construction and working of any one type of flotation equipment used for mineral processing.

(b) A cellulose acetate membrane having an area of 20 sq. cm. is used for reverse osmosis at 30°C . A salt solution comprising 10 kg NaCl/m^3 solution of density 1.005 g/cc is fed to the RO unit. The product is a dilute solution containing 0.5 kg NaCl/m^3 solution and has a density of 1 g/cc . Permeate flow rate is $5 \times 10^{-8} \text{ m}^3/\text{s}$. A pressure differential of 5885 kPa is used. Calculate the permeability constants of the membrane.

6. Write short notes on:-

- (a) Ion-exchange chromatography
 - (b) Microfiltration
 - (c) Moving bed adsorber
 - (d) Bonded phase chromatography
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