

(Following Paper ID and Roll No. to be filled in your  
Answer Books)

**Paper ID : 151851**

Roll No. 

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**B. TECH.**

**Theory Examination (Semester-VIII) 2015-16**

**ADVANCE SEPARATION TECHNOLOGY**

***Time : 3 Hours***

***Max. Marks : 100***

**Note: Attempt all Questions. Assume suitable data, if required.  
All Question carry equal marks.**

**1. Attempt any Four Parts of the following. (5×4 = 20)**

- (a) Describe the cascade arrangement for membrane processing.
- (b) Describe complete mixing model for Reverse Osmosis.
- (c) Define silt density index.
- (d) How polymeric membranes are characterized?
- (e) A solution containing 0.9wt% Protein is to undergo ultra-filtration using a pressure difference of 5 psi. The membrane permeability is  $A_w = 1.37 \times 10^{-2} \text{ kg/sec m}^2 \text{ atm}$ . Assume no effect of polarization. Predict the flux in  $\text{kg/secm}^2$  and unit of  $\text{gal/ft}^2\text{-day}$ . Which are flux used in industry.

- (f) What are the experimental techniques used for characterization of membranes?

**2. Attempt any Four Part of the following. (5×4 = 20)**

- (a) Write the classification of multistage separation process.
- (b) Discuss the factors influencing the separation process.
- (c) Define the pervaporization and also write three application with example.
- (d) How advance separation techniques id different than other separation techniques of chemical engineering?
- (e) Define separation factor and also mention the different condition of separation based on separation factor.
- (f) Explain the terms Electrodialysis and discuss its applications.

**3. Attempt any two parts of the following. (10×2 = 20)**

- (a) Calculate the Flux and the rate of removal of urea at steady state in g/hr from blood in a cuprophane membrane dialyzer at 37°C. The membrane is 0.025 mm thick and has an are of 4.0m<sup>2</sup>. The mass transfer coefficient on the blood side is estimated as  $Kc_1 = 1.25 \times 10^{-5}$  m/sec and that on the aqueous side is  $3.33 \times 10^{-5}$  m/sec. The permeability of the membrane is  $8.73 \times 10^{-6}$  m/sec. The concentration of urea in the blood is 0.002 urea/100 ml and that in the dialyzing fluid will be assumed zero.

- (b) Discuss the cross flow model for gas separation. Also discuss the various flow patterns used in membrane separation with suitable examples.
- (c) Discuss the working principle, Flux equation and applications of ultrafiltration process with neat sketch.

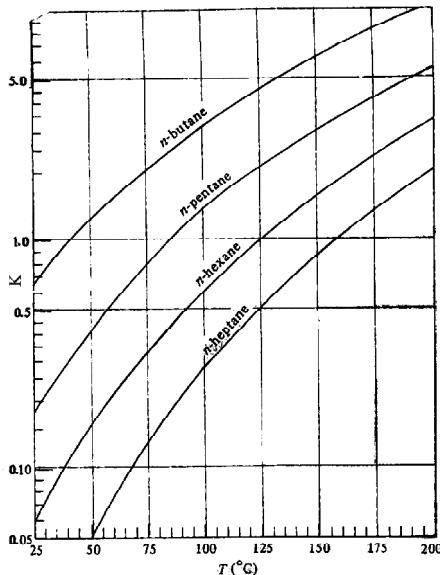
**4. Attempt any two part of the following :                      10×2=20**

- (a) What is Haemodialysis? Compare the dialysis process with electro dialysis.
- (b) A cellulose acetate membrane with an area of  $4.0 \times 10^{-3} \text{ m}^2$  is used at  $25^\circ\text{C}$  to determine the permeability constant for reverse osmosis of a feed salt solution containing  $12.0 \text{ Kg NaCl/m}^3$  ( $\rho = 1005.5 \text{ kg/m}^3$ ). The product solution has a concentration of  $0.468 \text{ Kg NaCl/m}^3$  ( $\rho = 997.3 \text{ kg/m}^3$ ). The measured flow rate is  $3.84 \times 10^{-8} \text{ m}^3/\text{sec}$  and the pressure difference used is  $56.0 \text{ atm}$ . Calculate the permeability constant and the solute Rejections.
- (c) Write short notes on the following :
  - (i) Molecular sieves separations
  - (ii) Gas permeability and gas separation membranes

**5. Attempt any two part of the following :                      10×2 = 20**

- (a) What is 'K' Factor in multicomponent separation by distillation?

Find the bubble point and the dew point temperature and the corresponding vapour and liquid composition for a mixture of 33 mole percent of n-butane, 37 mole percent n-pentane and 30 mole percent n-hexane at 1.2 atm. total pressure. The fig. shown in A.



- (b) Explain the terms T°C chromatographic separation also discuss the role of Gas-Liquid chromatography in chemical process industries.
- (c) Explain the following terms :-
- (i) Supercritical fluid chromatography.
  - (ii) Retention, Rejection and Permeate Flux
  - (iii) Ionic membrane
  - (iv) Energy required for Separation Processes