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B TECH
(SEM VIII) THEORY EXAMINATION 2017-18
ADVANCED SEPARATION TECHNOLOGY

Time: 3 Hours   *Total Marks: 100*

Note: **1**. Attempt all sections. If require any missing data; then choose suitably.

SECTION A

1.   **Attempt *all* questions in brief.**   **2 x 10 = 20**

   a) Define silt density index.
   b) Define inherent separation factor.
   c) Define MWCO.
   d) Define osmotic pressure.
   e) What is driving force for RO process?
   f) What are the practical applications of liquid membranes?
   g) Define Raoult's law.
   h) Define K value.
   i) Give at least four examples of the applications of per vaporation.
   j) What are experimental techniques used for characterization of membranes?

SECTION-B

2.   **Attempt any *three* of the following:**   **10 x 3 = 30**

   a) Write a note on energy requirement for separation process.
   b) Discuss in detail various kinds of cascades used in industries.
   c) Describe the reverse osmosis process with a neat sketch. Also discuss its uses.
   d) Describe the gas permeation through polymerized membranes. Mention the different kinds
       of polymerized membranes.
   e) Which experimental techniques are used for characterization of membranes?

SECTION C

3.   **Attempt any one part of the following:**   **10 x 1 = 10**

   a) Explain the advantages and limitations of the various new separation techniques.

   b) Discuss about the different types of molecular sieves giving their uses and working
       principle and operation.

4.   **Attempt any one part of the following:**   **10 x 1 = 10**

   a) Explain the construction and working of following membrane modules – a) Spiral wound
       module. b) Tubular module c) Hollow fibre module d) Plate and frame module.

   b) Write short notes on:

       (a) Thin layer chromatography (b) Liquid-liquid extraction
       (c) Concentration polarization (d) Henry's Law

5.   **Attempt any one part of the following:**   **10 x 1 = 10**

a) Explain the uses and characteristics of separation processes.

b) A liquid containing dilute solute A at a concentration $c_1 = 4 \times 10^{-2}$ kgmol/m^3 is flowing rapidly by a membrane of thickness $L = 3.5 \times 10^{-5}$m. The distribution coefficient $k' = 1.5$ and $D_{AB} = 7.5 \times 10^{-11}$ m^2/s in the membrane. The solute diffuses through the membrane and its concentration on the other side is $c_2 = 0.6 \times 10^{-2}$ kgmol/m^3. The mass transfer coefficient kc_1 is large and can be considered as infinite and $kc_2 = 2.0 \times 10^{-5}$ m/s.

(i) Derive the equation to calculate the steady-state flux N_A.
(ii) Calculate the flux and the concentration at the membrane interfaces.

6.   **Attempt any *one* part of the following:**   **10 x 1 = 10**

a) What is the difference between equilibrium governed separation process and rate governed separation process?

b) A mixture contains 5 g sucrose in 100 g of pure water at 25^{0}C. Determine the osmotic pressure. Molecular weight of sucrose is 342.30.

7.   **Attempt any *one* part of the following:**   **10 x 1 = 10**

a) Differentiate between liquid permeation membrane separation and gaseous permeation membranes separation and discuss its limitations and uses.

b) Write the short notes on the following:

   i.   Dialysis
  ii.   Membrane material
 iii.   Electro dialysis
 iv.   Gas permeability