BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

CLASS: BE **SEMESTER: VI**
BRANCH: CHEMICAL ENGG **SESSION : SP/2019**

SUBJECT : CL6005 MODERN SEPARATION PROCESSES

TIME: 1.5 HOURS **FULL MARKS: 25**

INSTRUCTIONS:
1. The total marks of the questions are 30.
2. Candidates may attempt for all 30 marks.
3. In those cases where the marks obtained exceed 25 marks, the excess will be ignored.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. The missing data, if any, may be assumed suitably.

Q1 (a) State the advantages and disadvantages of Energy Separating Agent (ESA) and Mass Separating Agent (MSA). [2]

(b) Define barrer. Convert one barrer to SI unit. [3]

Q2 Prepare a table for vapor-liquid equilibria (T-x-y) at constant pressure of 1 bar for mixtures of n-heptane and n-octane, which may be expected to form ideal solutions. Vapor pressure data for both components are given below: [5]

$$log_{10}(P) = A - \frac{B}{(T + C)}$$

P = vapor pressure (bar), T= temperature (K)

Component	Antoine Constants		
	A	B	C
n-heptane	4.02832	1268.636	-56.199
n-octane	4.04867	1355.126	-63.633

Note: Take only three temperature points including boiling points of n-heptane and n-octane and calculate corresponding x and y.

Q3 (a) Sketch the concentration profile for a reverse osmosis membrane. State the various concentration terms clearly. [2]

(b) What is reverse osmosis? Give the name of two applications of reverse osmosis. [3]

Q4 (a) Define molecular weight cut-off (MWCO) for an ultra-filtration membrane. [3]

(b) Calculate osmotic pressure of a solution containing 0.5 mol NaCl/1000 g water at 25°C. (Density of water = 997 kg/m^3). [2]

Q5 (a) What is electrophoresis? Give the name of two applications, where electrophoresis is performed. [2]

(b) What is native gel electrophoresis? Name the common factors which affect the separation in native gel electrophoresis. [3]

Q6 (a) Calculate the Debye length for 0.2(M) $CaCl_2$ aqueous solution. [5]

Given:
$N_A = 6.02\times10^{23}$ molecules/mole
$k_B = 1.38\times10^{-23}$ J/K
Dielectric constant = 80
Permittivity in vacuum = 8.85×10^{-12} C/(V.m)
Charge of electron = 1.6×10^{-19} C

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