

Day : Friday
Date : 23/11/2018

W-2018-3160

Time: 11.00 AM TO 02.00 PM
Max. Marks : 60.

N.B.

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Answer to both the sections should be written in **SEPARATE** answer book.
- 4) Assume suitable data if necessary.

SECTION – I

- Q.1** Consider the spherical catalyst in which species A diffuses into the catalyst (10) and undergoes a first order irreversible reaction $A \xrightarrow{k_1} B$. Assume homogeneous chemical reaction in a porous catalyst. Set up a differential shell balance and obtain an expression for the concentration profile.

OR

- a) Describe macroscopic mass balances. (05)
- b) A tank initially contains 1.4 m³ of brine solution with a concentration of 16.0 kg of salt per cubic meter of solution. A brine solution containing 48 kg of salt per cubic meter of solution enters the tank at a rate of 8.5 m³/h and is mixed perfectly with the existing solution. If the resulting brine solution leaves the tank at a rate of 8.5 m³/h, determine the time required for the salt in the tank to reach a concentration of 32.0 kg per cubic meter of solution. (05)
- Q.2** Describe the theory and mechanism of dielectrophoresis and electro dialysis. (10) Also state their commercial applications.

OR

- Discuss the basic principal of Ionic separation and describe the mechanism (10) of any one equipment used for electrophoresis.
- Q.3** The equilibrium adsorption of acetone vapor on activated carbon at 30⁰ C is (10) given by

gm adsorbed/gm carbon	0	0.1	0.2	0.3	0.35
Partial pressure of acetone, mm of Hg	0	2.0	12.0	42	92

A one liter flask contains air and acetone vapor at 1 atm and 30⁰ C with a partial pressure of acetone 100 mm Hg. Two grams of fresh activated carbon is introduced into the flask and it is sealed. Compute the final vapor concentration at 30⁰C and pressure inside the flask. Neglect the adsorption of air.

OR

- Discuss the stepwise procedures to obtain the number of stages required for continuous countercurrent adsorption. Draw a neat sketch and state the solute material balances. (10)

SECTION – II

Q.4 Discuss the circumstances under which azeotropic distillation is used? **(10)**
Explain in detail the process of azeotropic distillation. Comment on the selection of the third component.

OR

- a)** What are the considerations in selection of key components in a multicomponent distillation system? **(04)**
- b)** Explain the functioning of a pre and post fractionator in multicomponent distillation. **(06)**

Q.5 Explain the construction and working of flat and spiral wound membrane modules. Compare the two. **(10)**

OR

What are the effects of various process variables in gas permeation system? **(10)**

Q.6 What is reactive extraction? Give an example to explain the advantages. **(10)**

OR

With an example explain the working principle and advantage of supercritical fluid extraction. **(10)**

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