

Registration No. :

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Total number of printed pages – 2

B. Tech  
PECE 5406

**Eighth Semester Regular / Back Examination – 2015**  
**MODERN SEPARATION TECHNIQUES**

**BRANCH : CHEM**

**QUESTION CODE : J 159**

**Full Marks – 70**

**Time : 3 Hours**

*Answer Question No. 1 which is compulsory and any **five** from the rest.  
The figures in the right-hand margin indicate marks.  
Assume suitable notations and any missing data wherever necessary.  
Answer all parts of a question at a place.*



1. Answer the following questions : 2×10
  - (a) Name a membrane process in which phase change takes place.
  - (b) Differentiate between isotropic and anisotropic membranes.
  - (c) How much pressure is required to desalinate water ?
  - (d) What is the MWCO value of nano-filtration membranes ?
  - (e) An ultra-filtration membrane has a pore size range of \_\_\_\_\_ to \_\_\_\_\_  $\mu\text{m}$ .
  - (f) What is the operating pressure range of micro-filters ?
  - (g) State the size range of the retained species in dialysis in  $\text{\AA}$  units.
  - (h) In which state of polymer, more sorption of gas takes place ?
  - (i) Draw the profile for pressure gradient inside the membrane during pervaporation.
  - (j) Cite two industrial applications of emulsion liquid membrane.
2.
  - (a) Write the basic principle of membrane separation. 2
  - (b) Discuss in detail four major areas of application of membrane processes. 8
3.
  - (a) Discuss in brief the construction and operation of spiral wound type of membrane module with a neat diagram. 6
  - (b) With a neat figure, explain the phase inversion method of membrane manufacture. 4

**P.T.O.**

4. (a) What would be the Osmotic pressure of a solution containing 1.5 g of a polymer with a molecular weight of 18,000 dissolved in 100 ml of solution at 25°C. Given that density of water at 25°C is 997 kg/m<sup>3</sup>. Could this pressure be measured realistically with an Hg manometer ? 4+1
- (b) Discuss in detail the applications of reverse osmosis. 5
5. (a) Write the principle and industrial applications of nano-filtration. 5
- (b) Briefly discuss about the membranes used for ultra-filtration. 5
6. Blood from a patient's body is pumped through a concurrent hemodialyser at a rate of 300 ml/min to reduce the creatinine concentration from 150 mg to 15 mg%. The other undesirable substances are also expected to be removed in the process. The membrane area is 2.1 m<sup>2</sup> and the overall mass transfer coefficient is estimated to be 1.3 × 10<sup>-6</sup> m/s. The volume of blood in a normal human body is about 6 liter. If the flow rate of the dialysate fluid is maintained high, calculate the time required for dialysis. Assume that dialysate fluid is solute free. 10
7. (a) Discuss in detail the factors affecting pervaporation. 3
- (b) Discuss in detail the facilitated transport mechanism of mass transfer in liquid membranes. 7
8. Write short notes on any **two** of the following: 5×2
- (a) Design and operating parameters for a reverse osmosis process
- (b) Principle of dialysis
- (c) Knudsen diffusion
- (d) Applications of electro-dialysis.

