Registration No : | | | | | | | | | | |

Total number of pages : 03 **B.Tech.**
PCE6J004

6th Semester Regular Examination 2017-18
SEPARATION TECHNOLOGY
BRANCH : CHEM
Time : 3 Hours
Max Marks : 100
Q.CODE : C418

Answer Part-A which is compulsory and any four from Part-B.
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.

Part – A (Answer all the questions)

Q1. Answer the following questions : **(2 x 10)**

(a) Which of the following type of membrane module is having maximum packing density (m^2/m^3) ?
- i. Plate and frame
- ii. Spiral wound
- iii. Tubular
- iv. Hollow fibre

(b) The size of retained species in reverse osmosis is
- i. 1 – 10 Å
- ii. 10 – 100 Å
- iii. 100 – 1000 Å
- iv. 1000 – 10000 Å

(c) Brix is a scale that measures the weight of _____ in solution.
- i. Brine
- ii. Sugar
- iii. Chlorine
- iv. Alcohol

(d) Which of the following is a unit of resistance to solvent flow through a gel layer ?
- i. kg/m^2
- ii. $m^{-1} s^{-1}$
- iii. m^{-1}
- iv. $m\ s^{-1}$

(e) Which type of membrane is used in dialysis ?
- i. Porous
- ii. Microporous
- iii. Mesoporous
- iv. Nonporous

(f) Barrer is an unit used to express the _____ of dense film materials.
- i. Diffusion coefficient
- ii. Concentration gradient
- iii. Solubility coefficient
- iv. Permeability coefficient

(g) In pervaporation, the permeate side is usually _____.

i. at a pressure greater than atmospheric pressure
ii. at atmospheric pressure
iii. under vacuum
iv. None of these

(h) A typical electrodialysis membrane has a pore size of

i. 1 – 2 Å
ii. 10 – 20 Å
iii. 100 – 200 Å
iv. None of these

(i) Which of the following membranes is used for dehydration of alcohol ?

i. Cross linked PVA
ii. Polycarbonate
iii. Cellulose acetate
iv. Teflon

(j) If the partial pressure of a gas in contact with liquid is reduced, the amount of gas dissolved in liquid will

i. Increase
ii. Decrease
iii. Remain unchanged
iv. Decrease first then increase

Q2. **Answer the following questions :** **(2 x 10)**

(a) "Reduction of alcohol content of beer." Write the most suitable membrane process to be applicable for this operation.

(b) How does the swelling of a membrane affect diffusion of molecules through it ?

(c) What is membrane packing density ?

(d) What is the basic difference in transport mechanism of a charged and an uncharged molecule in nanofiltration ?

(e) Name the impurities of blood that can be removed by dialysis.

(f) What is the basic difference between the process of sorption and adsorption ?

(g) Is pervaporation an isothermal operation ?

(h) Differentiate between homogeneous and heterogeneous ion exchange membrane.

(i) What is the difference between a pore and a carrier in facilitated transport ?

(j) What is the purpose of rate controlled drug delivery ?

Part – B (Answer any four questions)

Q3. **(a)** Discuss in detail the four basic designs of membrane modules. **(10)**

(b) Briefly explain the phase inversion process of membrane manufacture. **(5)**

Q4. **(a)** Discuss the thermodynamic consideration of osmosis. **(10)**

(b) Discuss in brief the design and operating parameters for a reverse osmosis process. **(5)**

Q5. **(a)** Discuss in detail the factors affecting the performance of ultrafiltration. **(10)**

(b) Briefly explain the dead-end microfiltration. **(5)**

Q6. Blood from a patient's body is pumped through a concurrent hemodialyser at a rate of 302 ml/min to reduce the creatinineconcentration from 160 mg to 16 mg%. The other undesirable substances are also expected to be removed in the process. The membrane area is 2 m^2 and the overall mass transfer coefficient is estimated to be 1.3×10^{-6} m/s. The volume of blood in a normal human body is about 5.5 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. **(15)**

Q7. **(a)** Discuss about Knudsen diffusion for gas separation. **(8)**
(b) Discuss the factors affecting pervaporation. **(7)**

Q8. **(a)** Briefly discuss the benefits of liquid membranes. Also discuss about bulk liquid membranes. **(2+6)**
(b) Write briefly about the mechanism of facilitated transport. **(7)**

Q9. **Write briefly about :**
(a) Membrane contactor **(5)**
(b) Blood oxygenator **(5)**
(c) Advantages of membrane processes **(5)**