



Name :

Roll No. :

Invigilator's Signature :

CS/M.Tech (BT)/SEM-2/MBT-204/2013
2013
DOWNSTREAM PROCESSING

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

- i) Reverse osmosis is followed with
 - a) pressure driven operation
 - b) concentration driven operation
 - c) temperature driven operation
 - d) none of these.
- ii) Non-mechanical methods of cell disruption include
 - a) Osmotic shock
 - b) Homogenizer
 - c) Ball mill
 - d) None of these.



- iii) The stage wise operation of adsorption is called
- a) contact filtration
 - b) conventional adsorption
 - c) affinity adsorption
 - d) ion exchange.
- iv) In cross flow filtration, the feed flow is
- a) parallel to the surface of membrane
 - b) tangential to the surface of membrane
 - c) normal to the surface of membrane
 - d) none of these.
- v) Micro filtration removes particulate material ranging from size
- a) < 0.1 microns
 - b) < 0.001 microns
 - c) < 0.01 microns
 - d) < 0.0001 microns.
- vi) The meaning of TMP follows as
- a) Tangential Membrane Pressure
 - b) Theoretical Membrane Pressure
 - c) Trans Membrane Pressure
 - d) None of these.



vii) SWRO is a

- a) reverse osmosis desalination membrane process
- b) ultrafiltration desalination membrane process
- c) microfiltration desalination membrane process
- d) nanofiltration desalination membrane process.

viii) The correct mathematical relationship for permeation coefficient (P), solubility of the gas in the membrane polymer (S) and diffusivity of the gas in the polymer (D) is

- a) $P = D \times S$
- b) $P = D/S$
- c) $P = D \times (1/S)$
- d) $P = (1/D) \times S$.

ix) Chromatography is based on the

- a) separation of one solute from other constituents by being captured on the adsorbent
- b) different rate of movement of the solvent in the column
- c) different rate of movement of the solute in the column
- d) any of these.



- x) Liquid-liquid extraction depends on
 - a) distribution coefficient
 - b) volatility
 - c) solubility
 - d) partition coefficient.
- xi) Electrophoresis is used for the separation of
 - a) charged biomolecules
 - b) neutral biomolecules
 - c) organic molecules
 - d) inorganic molecules.
- xii) In gel filtration chromatographic separation, biomolecules are separated based on what property of biomolecules ?
 - a) Size
 - b) Charge
 - c) Hydrophobic interaction
 - d) Metal ion affinity.
- xiii) A system which require less solvent and produces a more concentrated extract phase, is desired with a
 - a) small distribution coefficients
 - b) very small distribution coefficients
 - c) constant distribution coefficients
 - d) large distribution coefficients.



xiv) Conventional adsorption is a

- a) irreversible process
- b) reversible process
- c) either reversible or irreversible process
- d) none of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

- 2. Briefly describe the operating components for the typical single-pass sea water reverse osmosis system.
- 3. Describe the production process of citric acid.
- 4. Briefly comment on aqueous two phase extraction process used for the separation of biomolecules.
- 5. Explain the role of so-called molecular weight cut-off (MWCO) often used as an indication of the ability of membranes to reject compounds.
- 6. What do you mean by Log removal capacity of microfiltration and ultrafiltration ? Explain the principles involved in inside-out filtration mechanism. $3 + 2$
- 7. Discuss non-mechanical methods of cell disruption.
- 8. Write down a short note on Chemical cell lysis.



GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

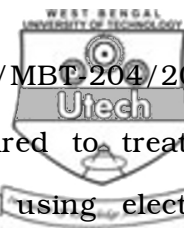
9. Write short notes on any *three* of the following : 3×5

- a) Pervaporation
- b) Desalination
- c) Hemofiltration
- d) Hemodialysis
- e) Membrane modules.

10. Give a complete flow diagram of isolation and purification of penicillin in a commercial plan. Briefly describe the major operations involved in this process.

11. Describe the operation process of rotary drum filtration.
Discuss different types of chromatographic techniques used in protein purifications. $2 \times 7\frac{1}{2}$

12. a) What is membrane fouling ?
- b) Describe the membrane resistance considering the various fouling mechanisms involved during membrane separation process.



- c) Determine the area and power required to treat a contaminated slurry of $4000 \text{ m}^3/\text{d}$ using electro-dialysis process comprised of 240 cells with 50% solute removal efficiency and 90% current efficiency.

Given : TDS = 2500 mg/L, cation and anion concentration = 0.01 g-eq/L, $CD/N = 500 \text{ mA/cm}^2$, Resistance = 5.0Ω . 5 + 5 + 5

13. Give an outline of the protein precipitation methods. What is isoelectric precipitation ? What are its advantages ? Discuss the theoretical principles and practice of salting out of protein by ammonium sulphate. 3 + 2 + 3 + 7
14. Describe the different types of stationary phases available for gas chromatography. Explain about the principle and application of Gel permeation chromatography. 5 + 10

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