

Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech (BT-NEW)/SEM-6/BT-602/2010

2010

BIOSEPARATION TECHNOLOGY

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 × 1 = 10

- i) Non-mechanical methods of cell disruption include
 - a) Osmotic shock
 - b) Homogenizer
 - c) Ball Mill
 - d) None of these.

- ii) Micro filtration (μF) remove particulate material ranging from size
 - a) Microns
 - b) < 0.001 microns
 - c) < 0.01 microns
 - d) < 0.0001 microns.



- iii) Electrophoresis is used for the separation of
- a) Charged biomolecules
 - b) Neutral biomolecules
 - c) Organic molecules
 - d) Inorganic molecules.
- iv) Liquid-liquid extraction depends on
- a) Distribution coefficient
 - b) Volatility
 - c) Solubility
 - d) Partition coefficient.
- v) 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.



- vi) Molecular weight of a protein can be determined by
- a) Size exclusion chromatography
 - b) Ion exchange chromatography
 - c) Pseudo-affinity chromatography
 - d) Affinity chromatography.
- vii) Basic principle of centrifugation depends on
- a) Concentration
 - b) Polarization
 - c) Centripetal force
 - d) Pressure gradient.
- viii) In reverse osmosis the deposition of solute molecules on membrane surface results in large resistance for solvent flow. This phenomenon is known as
- a) Reflection coefficient
 - b) Rejection coefficient
 - c) Break through point
 - d) Concentration polarization.
- ix) Cell disruption homogenizer is based on
- a) Applied voltage
 - b) Operation pressure
 - c) Salt concentration
 - d) Osmosis.



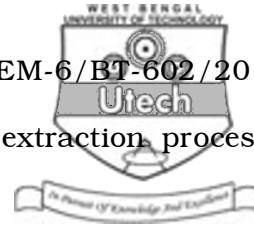
- x) Dialysis is a membrane operation used for the removal of low molecular weight solutes such as organic ions of mol. wt. range (MW)
- a) $10 < MW < 100$ b) $MW > 10$
c) $MW < 10$ d) $MW > 100$.
- xi) Which method is commonly used to separate inhibitory fermentation product such as ethanol from fermentation broth ?
- a) Aqueous two phase extraction
b) Liquid-liquid extraction
c) Adsorption
d) Ultrafiltration.
- xii) Chromatofocusing depends on which one of the following properties of a protein ?
- a) Molecular weight of protein
b) Hydrophobic residues of the protein
c) Isoelectric point of the protein
d) Affinity to the resin.

GROUP - B

(Short Answer Type Questions)

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

2. What are the characteristic features of solvent precipitation and isoelectric precipitation ? 5
3. Discuss non-mechanical methods of cell disruption. 5



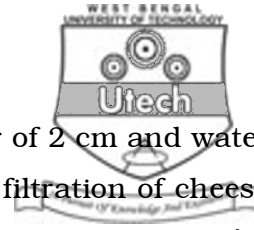
4. Briefly comment on aqueous two phase extraction process used for the separation of biomolecules. 5
5. What are the primary uses of reverse osmosis ? Give examples of membranes used in the process. 4 + 1
6. Write short notes on principle and application of Native-PAGE & SDS-PAGE. 5

GROUP – C

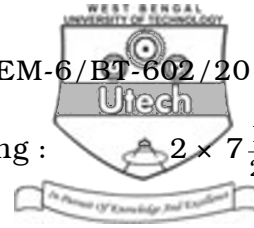
(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) Describe different types chromatographic separation technique available for the separation of metabolic product presents in fermentation broth.
- b) What are the basic principles exploited for the separation of biomolecules by chromatographic process ? 8 + 7



8. A tubular ultrafiltration unit with diameter of 2 cm and water permeability of $250 \text{ l}/(\text{m}^2) (\text{hr})$ is used for filtration of cheese whey. The protein has the diffusivity of $4 \times 10^{-7} \text{ cm}^2/\text{s}$ and the osmotic pressure (π) in the bar is given as $\pi = (4.4 \times 10^{-3})C - (1.7 \times 10^{-6})C^2$, where C is the protein concentration in gm/L.
- a) Calculate the mass transfer co-efficient unit, Re from the following co-relation $Sh = 0.0096 (Re)^{0.9} (Sc)^{0.35}$ where $Sh = K_c d/De$. 4 ×
- b) Calculate ΔP if the solution velocity is 1.5 m/s and the concentration of protein in the bulk (C_B) is 40 gm/L and that of Gel is 400 gm/L (C_G). The rejection is 100%. The density and viscosity of protein solution are the same as those of water. 6 + 9
9. a) What are the major advantages for recovering bioproducts using membrane based separation processes ?
- b) What are the operating conditions that affect performance in membrane based separation process ?
- c) Draw a plot of flux and rejection versus pressure for ultrafiltration.
- d) Which membrane process has been utilized the most for downstream biotechnology applications ? What are the general categories of such applications and elaborate on one *specific* example. [4 + 3 + 3 + (1 + 2 + 2)]



10. Write short notes on any *two* of the following :

$2 \times 7 \frac{1}{2}$

- a) Isopycnic ultracentrifugation
- b) Dialysis
- c) Gel filtration
- d) SDS - PAGE.

11. Give a complete flow diagram of isolation and purification of penicillin in a commercial plant. Briefly describe the major operations involved in this process. 15
