Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(BT)/SEM-6/BT-602/2012

2012

BIO-SEPARATION 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) Filtration rate depends on

a) pressure difference b) area of filter

c) viscosity of medium d) all of these.

ii) The separation of intracellular metabolite from bacterial cell is done by

a) Filtration b) Sonication

c) Centrifugation d) Adsorption.

iii) Centrifugation rate does not depend on

a) Density difference

b) Viscosity

c) Diameter of particle

d) None of these.

iv) Molecular weight of a protein can be determined by

a) size exclusion chromatography

b) ion-exchange chromatography

c) pseudo-affinity chromatography

d) affinity chromatography.

v) Non-mechanical methods of cell disruption include

a) Heat shock b) French press

c) Bead mill d) Homogenizer.

vi) Which one of the following is membrane mediated separation process ?

a) Affinity chromatography

b) Pervaporation

c) Gel filtration

d) Precipitation.

vii) In affinity chromatography if the reactive group on the matrix is OH group then coupling agent is

a) Bisepoxide

b) Dichlorotriazine

c) Tricyclic chloride

d) Cyanogen Bromide.

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) Breakthrough point

d) Concentration polarization.

ix) The most common exchange resin used in aqueous two phase extraction is

a) Polyvinyl difluoride

b) Polyethylene glycol

c) Polysulfone

d) Polytetrafluoroethylene.

x) In rate-zonal centrifugation separation, which type of particle characteristics is taken ?

a) Size b) Density

c) Charge d) Volume.

xi) The optimum length of spacer arm in affinity chromatography is

a) 4-6 carbon atom

b) 6-10 carbon atom

c) 10-16 carbon atom

d) 12-16 carbon atom.

xii) The method used to determine the relative molecular mass of protein is

a) Ion exchange chromatography

b) Gel filtration chromatography

c) Affinity chromatography

d) Chromatofocusing.

GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Write down the principle of Liquid Liquid extraction technique. Define the distribution coefficient and its importance in Liquid Liquid extraction. 2 + 3

3. What is dialysis ? How dialysis is used for isolation and purification of protein ? 2 + 3

4. Write short notes on any *one* of the following :

   a) Size exclusion chromatography

   b) SDS-PAGE

   c) Pseudoaffinity chromatography.

5. Discuss about the membrane fouling and concentration polarization during membrane based bioseparation.

6. Discuss the downstream processing steps in the intracellular enzyme from the fermentation broth.

GROUP – C
(Long Answer Type Questions)

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

7. a) What are ion-exchangers ? Classify them.

   b) Write the basic principle of ion exchange chromatography.

   c) Write about the application of ion exchange chromatography.

   d) What is isoelectric precipitation ? What are the advantages of it ? 3 + 5 + 3 + 4

8. a) Mention different parameters influencing the degree of cell disruption and rate of product release.

   b) The following data were obtained in a constant pressure filtration unit for filtration of a Yeast suspension :

Time (t) Min	4	20	48	76	120
Volume (V) L	115	365	680	850	1130

   Characteristics of filter are as follows A = 0·28 m^2, C = 1920 kg/m^3, μ = 2·9 × 10^{-3} kg/m-second, α = 4m/kg :

   i) Determine the pressure drop across the filter.

   ii) Determine the size of the filter for the same pressure drop to process 4000 lit of cell suspension is 20 minutes.

   iii) Determine the filter medium resistance (R_m).

   5 + 10

9. Penicillin is extracted from fermentation broth using Isoamyl acetate as organic solvent in continuous counter current cascade extraction unit. The flow rate of organic and aqueous phase are 10 lit/min and 100 lit/min respectively. The distribution coefficient of penicillin between organic and aqueous phase at pH-3 is 50. If the penicillin concentration in feed stream 20 g/l; determine the no. of stage required to reduce the penicillin concentration 0·1 g/l in the extraction unit.

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

11. Explain the following terms and their significances in column chromatography : $6 \times 2 + 3$

    a) Partition coefficient

    b) Retention time

    c) Retention volume

    d) Capacity factor

    e) Relative retention

    f) Resolution

    g) Plate height and number of theoretical plates.