BIOSEPARATION TECHNOLOGY (SEMESTER - 6)

CS/B.TECH(BT-N)/SEM-6/BT-602/09

1. .....
Signature of Invigilator

2. .....
Signature of the Officer-in-Charge

Reg. No. | | | | | | | | | | | | | | |

Roll No. of the Candidate | | | | | | | | | | | | | | |

CS/B.TECH(BT-N)/SEM-6/BT-602/09

ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009

BIOSEPARATION TECHNOLOGY (SEMESTER - 6)

Time : 3 Hours] [Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.
2. a) In **Group – A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question**.
   b) For **Groups – B** & **C** you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. Write on both sides of the paper.
3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
4. Read the instructions given inside carefully before answering.
5. You should not forget to write the corresponding question numbers while answering.
6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.
9. Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided

FOR OFFICE USE / EVALUATION ONLY

Marks Obtained

	Group – A										Group – B			Group – C			***Total Marks***	***Examiner's Signature***
Question Number																		
Marks Obtained																		

.....
Head-Examiner/Co-Ordinator/Scrutineer

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BIOSEPARATION TECHNOLOGY

SEMESTER - 6

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GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10

i) In gel filtration chromatographic separation, bio-molecules are separated based on what property of bio-molecules ?

a) Size b) Charge

c) Hydrophobic interaction d) Metal ion affinity. ☐

ii) To purify Lac-repressor from *E. coli* cell extract by affinity column chromatography, what type of ligand molecule will be immobilized to the gel matrix ?

a) Lac promoter RNA b) Lac operator DNA

c) Lac Z *m*RNA d) Lac I *m*RNA. ☐

iii) By Ni-NTA-Agarose affinity column chromatography what type of protein can you purify ?

a) GST-tagged protein b) 6 X His-tagged protein

c) Cys-tagged protein d) DNA binding protein. ☐

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) Cell disruption in homogenizer is based on

a) applied voltage b) operating pressure

c) salt concentration d) osmosis. ☐

vi) Pervaporation involves change of

a) mass volume b) isoelectric pH

c) applied voltage d) Phase. ☐

vii) Basic principle of centrifugation depends on

a) concentration b) polarization

c) centripetal force d) pressure gradient. ☐

viii) 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. ☐

ix) Ultrafiltration is used for separation with molecular weight range from

a) 0.1 – 10 μm b) 10 – 100 μm

c) 100 – 200 μm d) 200 – 500 μm. ☐

x) 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. ☐

xi) 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. ☐

GROUP – B

(Short Answer Type Questions)

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

2. Discuss the downstream processing steps in the production of intracellular enzyme from fermentation broth. 5

3. Write a short note on Pseudo-affinity chromatography. 5

4. Discuss the theoretical principles and practice of salting out of proteins by ammonium sulphate. 5

5. A centrifuge having a radius of bowl of 100 mm is rotating at 1000 r.p.m. Calculate the centrifugal force developed. 5

6. A mixture of two proteins *A* and *B* have to be separated by gel chromatography. The partition coefficient (K_D) for *A* is 0.5 and for *B* is 0.15. The void volume (V_o) in the column is 20 cm ^{3} and the included volume (V_i) within the gel particle is 30 cm ^{3} . The total volume of the column is 60 cm ^{3} . The flow rate of eluent is 100 cm ^{3} /h. Ignoring dispersion and other effects, how long will it take for *A* to exit the column ? How long is for *B* ? 5

GROUP – C

(Long Answer Type Questions)

Answer any *three* questions. 3 × 15 = 45

7. Write short notes on any *three* of the following : 3 × 5
   a) Affinity chromatography
   b) Non-mechanical methods of cell disruption
   c) Hyper-filtration
   d) Pervaporation.

8. a) What do you mean by membrane separation ? Name the different types of membrane separation processes. 1 + 2
   b) Write short notes on any *four* of the following : 4 × 3
      i) Reverse osmosis.
      ii) Ultra-filtration.
      iii) Membrane fouling.
      iv) Concentration polarization.
      v) Hollow fibre module.

9. a) Describe different types of Chromatographic separation technique available for the separation of metabolic products present in fermentation broth. 10

b) What are the basic principles exploited for the separation of biomolecules by chromatographic process ? 5

10. a) Aqueous two-phase extraction is used to recover alpha-amylase from solution. A polyethylene glycol-dextran mixture is added and the solution separates into two phases. The partition coefficient is 4.2. Calculate the maximum possible enzyme recovery when :

i) the volume ratio of upper to lower phases is 5.0 and

ii) the volume ratio of upper to lower phases is 0.5. 7

b) Cell free fermentation liquor contains 8×10^{-5} mol / lit. immunoglobulin *G*. It is proposed to recover at least 90% of this antibody by adsorption on synthetic, non-polar resin. Experimental equilibrium data are correlated as follows :

$$C^*_{AS} = 5.0 \times 10^{-5} \; C^{*0.30}_{A}$$

where C^*_{AS} is mol solute adsorbed per cm^3 adsorbent and C^*_A is liquid phase conc. in mol/lit. What minimum quantity of resin is required to treat 2 m^3 fermentation liquor in a single-stage mixed tank ? 8

11. Describe in brief the operations involved for the isolation and purification of ethanol or any organic acid from commercial plant. (Complete flowchart is a must) 15

END