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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: VI - THEORY EXAMINATION (2025 - 2026)

Subject: Bioseparation Engineering

Time: 3 Hours

Max. Marks: 100

General Instructions:

IMP: Verify that you have received the question paper with the correct course, code, branch etc.

1. This Question paper comprises of **three Sections -A, B, & C**. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.

2. Maximum marks for each question are indicated on right -hand side of each question.

3. Illustrate your answers with neat sketches wherever necessary.

4. Assume suitable data if necessary.

5. Preferably, write the answers in sequential order.

6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION-A

20

1. Attempt all parts:-

(1.1) Haemoglobin has (CO1, K1)

1

- (a) Primary structure
- (b) Secondary structure
- (c) Tertiary structure
- (d) Quaternary structure

(1.2) When the pH of a protein is lowered _____ (CO1, K1)

1

- (a) temperature decreases
- (b) negatively-charged groups neutralize
- (c) positively-charged groups neutralize
- (d) positively-charged groups decrease

(1.3) If the dispersed phase is a liquid and the dispersion medium is solid, the colloid is known as (CO2, K1)

1

- (a) foam
- (b) sol
- (c) emulsion
- (d) gel

(1.4) Which of the following kinds of catalysis can be explained by the adsorption theory? (CO2, K1)

1

- (a) enzyme catalysis
- (b) homogeneous catalysis
- (c) acid base catalysis
- (d) heterogeneous catalysis

- (1.5) The separating funnel is used mainly to segregate- (CO3, K1) 1
- (a) Two immiscible liquids
 - (b) Two miscible solids
 - (c) Homogenous mixture
 - (d) Heterogeneous mixture
- (1.6) What is the turbidity for hollow fibers? (CO3, K1) 1
- (a) less than 15
 - (b) less than 1
 - (c) less than 10
 - (d) less than 12
- (1.7) What is filter membrane made up of? (CO4, K1) 1
- (a) Thin layer of collodion, cellulose acetate
 - (b) Thick layer of collodion, cellulose acetate
 - (c) Thin layer of collodion
 - (d) Thin layer of cellulose acetate
- (1.8) What is the pore size in membrane filter? (CO4, K1) 1
- (a) 0.12–0.25 μm
 - (b) 0.22–0.45 μm
 - (c) 0.32–0.55 μm
 - (d) 0.52–0.65 μm
- (1.9) Hand lapping is used mainly for (CO5, K1) 1
- (a) Press work dies
 - (b) Races of Roller bearings
 - (c) Gears
 - (d) Pistons
- (1.10) How does concentration affect crystallization? (CO5, K1) 1
- (a) Increase in concentration leads to large crystals
 - (b) Decrease in concentration leads to large crystals
 - (c) Increase in concentration leads to small crystals
 - (d) Decrease in concentration leads to small crystals

2. Attempt all parts:-

- (2.1) What are biomolecules? (CO1, K1) 2
- (2.2) What is the basic principle of extraction? (CO2, K1) 2
- (2.3) What are the different types of restriction enzymes? (CO3, K1) 2
- (2.4) What is void time in chromatography? (CO4, K1) 2
- (2.5) What is half time of crystallization? (CO5, K1) 2

SECTION-B

30

Answer any one of the following:-

- (3.1) Describe in detail about the different characteristics of biomolecules? (CO1, K1) 6

(3.2)	How does sonication cause cell lysis, and what precautions should be taken while using it? (CO1, K1)	6
Answer any one of the following:-		
(3.3)	Discuss in detail about the working principle of gel electrophoresis? (CO2, K1)	6
(3.4)	What are the stages of decoction extraction? How it is different from percolation? (CO2, K1)	6
Answer any one of the following:-		
(3.5)	Explain how surface functionalization enhances the performance of polymer beads for biomolecule immobilization? (CO3, K2)	6
(3.6)	Discuss the criteria of selecting polymers for immobilization of enzymes and proteins? (CO3, K2)	6
Answer any one of the following:-		
(3.7)	Which type of chromatography separates proteins based on their charge? Discuss in detail? (CO4, K2)	6
(3.8)	How does High Performance Liquid Chromatography (HPLC) ensure specificity during separation of biomolecules? Explain with suitable example? (CO4, K2)	6
Answer any one of the following:-		
(3.9)	What do you understand by crystallization? Also write the different steps of crystallization? (CO5, K1)	6
(3.10)	Discuss the integration of drying with upstream and downstream processes in continuous biomanufacturing? (CO5, K2)	6
SECTION-C		50
4. Answer any <u>one</u> of the following:-		
(4.1)	Describe the role of membrane porosity and material selection in microfiltration and ultrafiltration? (CO1, K1)	10
(4.2)	How does pH and ionic strength influence protein separation using centrifugation and filtration techniques? (CO1, K1)	10
5. Answer any <u>one</u> of the following:-		
(5.1)	Describe the principles and applications of Soxhlet Extraction. Justify your answer with relevant examples. (CO2, K1)	10
(5.2)	List the differences between infusion, decoction, and digestion methods in plant extract preparation. (CO2, K1)	10
6. Answer any <u>one</u> of the following:-		
(6.1)	Explain different chemicals strategies for the purification of bio-based products. (CO3, K2)	10
(6.2)	Employ the advancements in flow cytometry for single-cell analysis and its application in immunophenotyping and cancer diagnosis. (CO3, K3)	10
7. Answer any <u>one</u> of the following:-		
(7.1)	Discuss various modes of separation of chromatography. Explain affinity chromatography with its industrial applications. (CO4, K2)	10
(7.2)	What interdisciplinary approaches can be combined with gel electrophoresis to enhance its application in system biology? (CO4, K1)	10

8. Answer any one of the following:-

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| (8.1) | Mention various techniques involved in polishing of fermented products. (CO5, K1) | 10 |
| (8.2) | Describe the decision-making process in selecting appropriate dryers/crystallizers for drying. (CO5, K1) | 10 |

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