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Printed Page:-4 **Subject Code:- BBT0601**

Roll. No:

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) Which of the following is NOT a technique used for the separation of biomolecules? (CO1, K1) 1

(a) Centrifugation
(b) Filtration
(c) Spectroscopy
(d) Flocculation

(1.2) Microfiltration typically removes particles in the size range of: (CO1, K1) 1

(a) 10-100 nm
(b) 0.1-10 μm
(c) 1-100 μm
(d) 0.001-0.1 nm

(1.3) What is the primary solvent used in Soxhlet extraction? (CO2, K1) 1

(a) Acetone
(b) Methanol
(c) Water
(d) Ethanol

(1.4) Which method uses continuous refluxing and siphoning of solvent? (CO2, K1) 1

(a) Infusion
(b) Soxhlet
(c) Counter-current
(d) Percolation

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(1.5) What is the primary driving force in ultrafiltration? (CO3, K1) 1

(a) Temperature
(b) Pressure
(c) pH gradient
(d) Electromagnetic field

(1.6) A student uses UF to separate a 70 kDa enzyme from a buffer. However, enzyme is found in permeate. What could be the issue? (CO3, K1) 1

(a) Too high pressure
(b) Wrong MWCO
(c) High temperature
(d) Poor mixing

(1.7) Which chromatographic technique is best suited for separating volatile compounds? (CO4, K1) 1

(a) Paper Chromatography
(b) Gas-Liquid Chromatography
(c) Gel Filtration
(d) Ion Exchange

(1.8) What is Rf value in chromatography? (CO4, K1) 1

(a) Ratio of solvent front to compound distance
(b) Ratio of compound distance to solvent front
(c) Ratio of polarity to charge
(d) Molecular weight ratio

(1.9) Drying in downstream processing is mainly used to: (CO5, K1) 1

(a) Kill bacteria
(b) Remove solvent
(c) Add nutrients
(d) Change color

(1.10) Case studies in downstream processing help in: (CO5, K1) 1

(a) Applying theory to real problems
(b) Designing electrodes
(c) Calculating temperature
(d) Plant irrigation

2. Attempt all parts:-

(2.1) Define biomolecule separation and state its significance in biotechnology. (CO1, K1) 2

(2.2) Why is counter-current extraction more efficient than batch extraction? (CO2, K1) 2

(2.3) List two common materials used for ultrafiltration membranes. (CO3, K1) 2

(2.4) What are the typical components involved in paper electrophoresis? (CO4, K1) 2

(2.5) How can heat-sensitive biomolecules be protected during drying? (CO5, K1) 2

SECTION-B 30

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Answer any one of the following:-

(3.1) Describe the principle of centrifugation and list the major types of centrifugation. (CO1, K2) 6

(3.2) Explain the various applications of filtration in biotechnology and bioprocessing. (CO1, K2) 6

Answer any one of the following:-

(3.3) Describe the basic procedure of microwave-assisted extraction and ultrasonic-assisted extraction (CO2, K2) 6

(3.4) Analyze and compare Soxhlet extraction, Microwave-Assisted Extraction (MAE), and Ultrasound-Assisted Extraction (UAE) techniques for alkaloid extraction in different practical applications. (CO2, K3) 6

Answer any one of the following:-

(3.5) Explain the mechanism and application of cross-linking for enzyme immobilization. (CO3, K2) 6

(3.6) Explain how surface functionalization enhances the performance of polymer beads for biomolecule immobilization. (CO3, K2) 6

Answer any one of the following:-

(3.7) Describe the methodology and instrumentation involved in Affinity Chromatography. (CO4, K2) 6

(3.8) Explain how High Performance Liquid Chromatography (HPLC) ensures specificity during the separation of biomolecules. (CO4, K2) 6

Answer any one of the following:-

(3.9) Illustrate the effect of air velocity, humidity, and temperature on drying efficiency in a drying process. (CO5, K3) 6

(3.10) Compare freeze drying and vacuum drying in terms of efficiency, cost, and suitability for sensitive products. (CO5, K2) 6

SECTION-C 50

4. Answer any one of the following:-

(4.1) Describe the working principles of bead milling and high-pressure homogenization. (CO1, K2) 10

(4.2) Describe enzymatic lysis methods for cell disruption. Provide examples of scenarios where enzymatic lysis is superior to physical methods. (CO1, K2) 10

5. Answer any one of the following:-

(5.1) Describe the importance of RNase-free techniques in RNA extraction and analysis. (CO2, K2) 10

(5.2) Differentiate between the adsorption and membrane separation techniques for protein purification. (CO2, K3) 10

6. Answer any one of the following:-

(6.1) Explain large-scale applications of magnetic bead separation in clinical diagnostics and pharmaceutical purification. Include challenges in scalability and cost-effectiveness. (CO3, K2) 10

(6.2) Compare and contrast all five immobilization techniques based on strength of 10

interaction, stability, reusability, and cost-effectiveness. (CO3, K2)

7. Answer any one of the following:-

(7.1) Explain the complete methodology of column chromatography along with its principles, advantages, and challenges in industrial applications. (CO4, K2) 10

(7.2) Illustrate the role of buffer composition, pH, and ionic strength in optimizing protein separation by size, charge, and chemical nature. Provide a scientific rationale. (CO4, K4) 10

8. Answer any one of the following:-

(8.1) Apply product polishing methods to improve the purity and stability of bioproducts during downstream processing. (CO5, K3) 10

(8.2) Explain the process for drying with the help of diagram and also explain the applications applied to recombinant protein purification. (CO5, K2) 10