Q. Code:372276

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

M.E. / M. TECH DEGREE EXAMINATIONS, MAY 2024

Second Semester

BY22202 - ADVANCED BIOSEPARATION TECHNOLOGY

(Biotechnology)

(Regulation 2022)

TIME: 3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO1	Understand of the physicochemical properties of biotechnological products and economics of bioseparation techniques.	**2**
CO2	Gain the knowledge on equipment selection and design of mechanical separation process for recovery of biotechnological products.	**3**
CO3	Identify and optimize the suitable bioproduct isolation process at laboratory and pilot scale.	**4**
CO4	Thoroughly understand the chromatographic separation methods and equipment selection.	**4**
CO5	Have complete knowledge of stability of biotechnology products and should be capable of formulation and stabilization for enhanced shelf-life. Apply principles of various unit operations used in bioseparation processes and enhance problem solving techniques.	**3**

PART - A (20 x 2 = 40 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Elucidate the challenges associated with bioproduct purification.	**1**	**2**
2.	Demonstrate how the attributes of biomolecules impact bioseparation.	**1**	**2**
3.	Briefly explain the concept of flocculation in biotechnological processes.	**1**	**2**
4.	How does the size of proteins influence their separation?	**1**	**2**
5.	How does mechanical cell disruption differ from physical and chemical methods?	**2**	**2**
6.	Detail the procedure for eliminating insoluble debris from a cell suspension.	**2**	**2**
7.	List two types of filtration commonly used for removing insoluble debris in bioprocessing.	**2**	**2**
8.	Explain why Relative Centrifugal Force (RCF) is preferred over Rotations Per Minute (RPM) in centrifugation. Also, include the formula for converting RPM to RCF.	**2**	**2**
9.	Why are membrane modules important in membrane processes? Provide reasoning.	**3**	**3**
10.	Distinguish between microfiltration and ultrafiltration by examining their variance in pore size and their respective industrial applications.	**3**	**2**

11.	Contrast reverse osmosis with dialysis, highlighting their differences in principle, application, and effectiveness.	**3**	**2**
12.	How does aqueous two-phase extraction differ from reverse micellar extraction in terms of mechanism and applications?	**3**	**2**
13.	Name two types of chromatographic terms and its importance in chromatographic separation.	**4**	**2**
14.	Suppose the crude culture filtrate of Aspergillus niger harbors enzymes with varying charges but identical molecular masses. Which chromatographic method would be suitable for purifying these enzymes, and why?	**4**	**3**
15.	Outline the purpose of a mobile phase in chromatography?	**4**	**2**
16.	Discuss the importance of pH and buffer selection in optimizing separations in reversed-phase chromatography.	**4**	**3**
17.	Enumerate the adverse consequences of the thermal drying process.	**5**	**3**
18.	How does the supersaturation coefficient influence the rate of nucleation in a crystallization process?	**5**	**2**
19.	What makes lyophilization the preferred method for the final polishing process of biomolecules?	**5**	**3**
20.	Enumerate the stages of purifying cephalosporin.	**5**	**2**

PART - B (5 x 10 = 50 Marks)

		Marks	CO	RBT LEVEL
21.(a)	Investigate the unique characteristics of proteins and enzymes in terms of their size, stability, and properties, particularly regarding their separation methodologies.	**10**	**1**	**3**
	(OR)			
(b)	Examine how upstream production methods influence the choice of purification strategies in biotechnological processes	**10**	**1**	**3**
22.(a)	Discuss the importance of cell lysis in the purification industry. Compare and contrast the effectiveness, advantages, and limitations of physical, chemical, and mechanical methods for cell disruption in extracting intracellular products.	**10**	**2**	**3**
	(OR)			

(b)	Deliberate the challenges associated with biomass separation in bioprocessing and the strategies employed to overcome these challenges using filtration and centrifugation techniques.	**10**	**2**	**3**
23.(a)	Investigate the extraction techniques appropriate for isolating enzymes from contaminants in a biocompatible setting, using a crude culture extract as a starting point. Describe the various biphasic systems utilized in this extraction procedure.	**10**	**3**	**4**
	(OR)			
(b)	Analyze the bioseparation methods employed to concentrate and fractionate biomolecules by exploiting the hydrophobic patches on their surfaces, with a focus on a single-step procedure.	**10**	**3**	**4**
24.(a)	Imagine the crude culture broth of Candida albicans containing enzymes of diverse molecular masses but sharing identical charges. What chromatographic separation method might be employed for purifying these enzymes, and provide a comprehensive justification with an accompanying clear illustration?	**10**	**4**	**4**
	(OR)			
(b)	Discuss the process of preparing hydroxyapatite chromatography media and the factors influencing the choice of suitable matrix properties. Analyze how these factors affect the chromatographic process's performance and reproducibility.	**10**	**4**	**4**
25.(a)	Elaborate on the concept of crystallization, encompassing the occurrences of nucleation and crystal growth. Provide examples of biotechnology industrial processes where crystallization is utilized.	**10**	**5**	**4**
	(OR)			
(b)	Investigate the challenges associated with freeze drying and the strategies employed to overcome them. Discuss advancements in freeze-drying technology and their impact on product quality and process efficiency.	**10**	**5**	**4**

PART - C (1 x 10 = 10 Marks)

(Q.No.26 is compulsory)

		Marks	CO	RBT LEVEL
26.	Discuss in detail the principles underlying affinity chromatography, including the types of interactions involved and the factors influencing binding specificity and affinity. Furthermore, elaborate on the applications of affinity chromatography in biotechnology and biomedical research, providing examples of its use in isolating and purifying specific biomolecules. Finally, evaluate the advantages and limitations of affinity chromatography compared to other chromatographic techniques, and propose potential advancements in the field to enhance its efficacy.	**10**	**4**	**5**