



**M.TECH DEGREE EXAMINATIONS: DEC 2022**

(Regulation 2018)

First Semester

**BIOTECHNOLOGY**

P18BTI1203 : Bioproduct Recovery and Purification

**COURSE OUTCOMES**

- CO1:** Understand the various principles involved in bioseparation and cell disruption techniques
- CO2:** Explain the different types of filtration and centrifugation techniques used in bioproduct recovery
- CO3:** Understand the various techniques in different unit operations involved for the isolation and extraction of bio-products from biological samples
- CO4:** Select and use various methods of chromatography in protein purification
- CO5:** Illustrate different methods of final polishing for bio-products produced at lab and industrial level
- CO6:** Develop a process design and choose the appropriate purification steps and perform the techno-economic analysis for purification of bioproducts

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-**

**PART A (10 x 1 = 10 Marks)**

1. Which of the following is the sequence of cell wall components in G<sup>-</sup> bacteria? CO1 [K<sub>2</sub>]
  - a) Plasma membrane, periplasmic space, peptidoglycan, & Outer membrane
  - b) Outer membrane, peptidoglycan, periplasmic space, & plasma membrane
  - c) Outer membrane, periplasmic space, plasma membrane & peptidoglycan
  - d) Outer membrane, periplasmic space, peptidoglycan, & plasma membrane
2. Which of the following method disrupts the cell wall by extracting the lipids in it? CO1 [K<sub>2</sub>]
  - a) Ultrasonication
  - b) French Press
  - c) Detergents
  - d) Buffers
3. Pharmaceutical industry employs ..... in order to recycle flow or add value to later products. CO2 [K<sub>4</sub>]
  - a) Gel-filtration chromatography
  - b) Ultrafiltration
  - c) Salt precipitation
  - d) Solvent precipitation



**PART B (10 x 2 = 20 Marks)**

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|--|-----|-------------------|
| 11. Differentiate Gram positive microbes with Gram negative microbes.                              | CO1 | [K <sub>2</sub> ] |
| 12. List out any four commercially available low-volume and high-price bioproducts.                | CO1 | [K <sub>2</sub> ] |
| 13. Define flux in membrane filtration and name any two causative agents for flux.                 | CO2 | [K <sub>3</sub> ] |
| 14. Distinguish conventional dead-end-filtration with cross-flow filtration.                       | CO2 | [K <sub>2</sub> ] |
| 15. What is counter-current extraction in solvent extraction process?                              | CO3 | [K <sub>2</sub> ] |
| 16. What is isoelectric pH?  | CO3 | [K <sub>3</sub> ] |
| 17. What are the differences between normal-phase chromatography and reverse-phase chromatography? | CO4 | [K <sub>2</sub> ] |
| 18. State the reasons for the precipitation of proteins at high salt concentrations.               | CO4 | [K <sub>4</sub> ] |
| 19. List the methods to concentrate or saturate the molecules for crystallization process.         | CO5 | [K <sub>2</sub> ] |
| 20. What do you meant by operating cost in the production of biotechnology products?               | CO6 | [K <sub>3</sub> ] |

**PART C (6 x 5 = 30 Marks)**

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|--|-----|-------------------|
| 21. Describe any two mechanical methods to disrupt the cells with neat diagrams.                             | CO1 | [K <sub>2</sub> ] |
| 22. Explain the operation and applications of rotary drum vacuum filtration                                  | CO2 | [K <sub>3</sub> ] |
| 23. Discuss in detail on working conditions and applications of tubular bowl centrifuge with a neat diagram. | CO2 | [K <sub>1</sub> ] |
| 24. Explain the separation of bioproduct and impurities by countercurrent extraction with suitable sketch?   | CO3 | [K <sub>2</sub> ] |
| 25. Describe the important considerations or steps during scale-up criteria for chromatography.              | CO4 | [K <sub>4</sub> ] |
| 26. Discuss in detail on different types of crystallization and their applications.                          | CO5 | [K <sub>3</sub> ] |

**Answer any FOUR Questions**

**PART D (4 x 10 = 40 Marks)**

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|--|-----|-------------------|
| 27. How are molecular weight of polymers determined by ultracentrifuges?           | CO2 | [K <sub>3</sub> ] |
| 28. Describe the aqueous two-phase separation/extraction process with neat diagram | CO3 | [K <sub>2</sub> ] |

29. Discuss in detail on principle and methodology for the separation of proteins by gel-filtration chromatography CO4 [K<sub>2</sub>]
30. Explain the principle and protocol for the purification of recombinant proteins using metal affinity chromatography CO4 [K<sub>2</sub>]
31. Describe the industrial production of monoclonal antibody with a flow sheet CO5 [K<sub>1</sub>]

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