| Reg.No.: | | | | | | | | | | | | |
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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

**Question Paper Code: 90029**

M.E. / M.Tech. DEGREE END-SEMESTER EXAMINATIONS – JAN. / FEB. 2026
Second Semester
Biotechnology
P23BT205 – ADVANCED BIOSEPARATION TECHNOLOGY
(Regulation 2023)

Time: Three Hours | Maximum: 100 Marks

Answer ALL the questions

| Knowledge Levels (KL) | K1 – Remembering | K3 – Applying | K5 - Evaluating |
|---|---|---|---|
| | K2 – Understanding | K4 – Analyzing | K6 - Creating |

PART – A

(10 x 2 = 20 Marks)

| Q.No. | Questions | Marks | KL | CO |
|---|---|---|---|---|
| 1. | List the rheological properties of fermentation broths. | 2 | K1 | CO1 |
| 2. | A centrifuge is operated in a fixed angle rotor with the radius of 8 cm at 22938g. Calculate the speed in rpm. | 2 | K3 | CO1 |
| 3. | What are the causes of membrane fouling? | 2 | K2 | CO2 |
| 4. | List the applications of integrated membrane reactor. | 2 | K1 | CO2 |
| 5. | Calculate the amount of gentamycin adsorbed per unit weight of activated carbon that adsorbs $9.8x10^{-6}$ mol/cm$^3$. This process follows Langmuir isotherm with constant K of $2x10^{-5}$ mol/L and the concentration of the solute in the solution = $4x10^{-8}$ mol/cm$^3$. | 2 | K4 | CO3 |
| 6. | Exemplify the significance of partition coefficient (K) in extraction. | 2 | K2 | CO3 |
| 7. | A chromatographic separation of a two components samples on a 50 cm column gave the retention times for the solutes A and B as 2.5 and 3.1 minutes with base widths of the two chromatographic peaks being 0.24 and 0.3 minutes respectively. Calculate the<br>i. Number of theoretical plates<br>ii. Plate height<br>iii. Resolution of the two peaks | 2 | K4 | CO4 |
| 8. | Define lyophilization, and mention the applications. | 2 | K2 | CO4 |
| 9. | Notify the steps involved in making of cheese. | 2 | K3 | CO5 |
| 10. | Sketch the diagram of Sewage Treatment Unit. | 2 | K2 | CO5 |

## PART – B

(5 x 13 = 65 Marks)

| Q. No. | | Questions | Marks | KL | CO |
|---|---|---|---|---|---|
| 11. | a) | Elucidate the generalized block diagram of various stages of downstream processing of bioproducts and explain the unit operation involved in primary, intermediate and final purification stages. | 13 | K3 | CO1 |
| | | (OR) | | | |
| | b) | The centrifugal separation of a biomass of 80 μm sized cells of density 1.04 $kg \cdot m^{-3}$ was carried out in a tubular centrifuge having a diameter of 15 cm and rotating at 1200 rpm. | 13 | K3 | CO1 |
| | | i. Calculate the residence time if the distance between the liquid surface and the axis of rotation was 0.8, the liquid density and the liquid viscosity were 1.0 $kg \cdot m^{-3}$ and 0.013 $g \cdot cm^{-1} \cdot s^{-1}$ respectively. | | | |
| | | ii. What would be the volumetric capacity of the centrifuge is its length was 40 cm? | | | |
| | | iii. What will be the time required for centrifuging 1000 litres of broth? | | | |
| | | iv. Calculate the $\Sigma$ factor. | | | |
| | | v. What will be the time required for centrifuging 1000 litres of broth? | | | |
| 12. | a) | You are living in an apartment which is not having the facility to provide drinking water. Water available contains high concentration of salt. Design a single/multi stage membrane processing unit for this purification process. Select the membrane type, modules and operating condition suitable for the operation. Explain your selection. | 13 | K4 | CO2 |
| | | (OR) | | | |
| | b) | Brief on microfluidics-based separation of biomolecules and compare its impact with membrane based filtration from industrial point of view. | 13 | K3 | CO2 |
| 13. | a) | Demonstrate the salient features of adsorption in a CSTR. How is the experimental data obtained? | 13 | K3 | CO3 |
| | | (OR) | | | |
| | b) | i. Give an account of different solvent extraction methods with suitable examples. | 5 | K3 | CO3 |
| | | ii. An organic acid dissolved in 47 liters of organic solvent is to be washed with 10 liters of water. From the past extractions, we expect that $x^2 = 0.001\ y$ where both concentrations x and y are in mg/liters. The initial concentration of x is 1 mg/liter: what is the fraction extracted? | 8 | | |

| | | | | | |
|---|---|---|---|---|---|
| 14. | a) | Compare and contrast the basic theory and applications of Bio affinity and Pseudo affinity chromatography. | 13 | K2 | CO4 |
| | | (OR) | | | |
| | b) | Illustrate the working of fluidized bed dryers and spray dryers with their applications in the product development. | 13 | K2 | CO4 |
| 15. | a) | Exemplify the separation and fractionation of milk proteins in making of industrial products with suitable case study. | 13 | K3 | CO5 |
| | | (OR) | | | |
| | b) | Analyze the membrane bioreactor utility involved in the sewage water treatment. Explain it in detail with an example. | 13 | K3 | CO5 |

## PART – C

(1 x 15 = 15 Marks)

| Q.No. | | Questions | Marks | KL | CO |
|---|---|---|---|---|---|
| 16. | a) | As a biotechnologist, you have invented a novel material and the formulation strategy for a bioproduct. Describe the importance of formulation optimization to acquire its effectiveness. How are final products formulated after lyophilization. Emphasize the steps involved in the process of development of bioproduct after microbial separation. | 15 | K3 | CO4 |
| | | (OR) | | | |
| | b) | A pilot-scale gel chromatography column packed with Sephacryl resin is used to separate two hormones A and B. The column in 5cm in diameter and 0.3 m high; the void volume is $1.9 \times 10^{-4}$ $m^3$. the water regain value of the gel is $3 \times 10^{-3}$ kg $m^{-3}$ dry Sephacryl; the density of wet gel is $1.25 \times 10^3$ kg $m^{-3}$. The partition co-efficient for hormone A is 0.38; the partition co-efficient for hormone B is 0.15. If the eluant flow rate is 0.71 $h^{-1}$, what is the retention time for each hormone? | 15 | K4 | CO4 |