

20/6/20 (E)  
6/1/20

Exam.Code:0910  
Sub. Code: 6717

2062  
B.E. (Biotechnology) Sixth Semester  
BIO-614: Down Stream Processing

Time allowed: 3 Hours

Max. Marks: 50

**NOTE:** Attempt any five questions.

x-x-x

Q1.

- a) In SDS-PAGE, protein sample is first treated with detergent sodium dodecyl sulfate (SDS), in order to 1
- i) Make the protein become negatively charged.
  - ii) Make the protein become positively charged.
  - iii) Renature the protein.
  - iv) Adjust the pH of protein.
- b) Match the coefficients in group 1 with their corresponding downstream processing steps given in group 2. 2
- |                              |                                 |
|------------------------------|---------------------------------|
| Group 1                      | Group 2                         |
| P. Sedimentation coefficient | 1. Aqueous two-phase extraction |
| Q. Partition coefficient     | 2. Ultrafiltration              |
| R. Rejection coefficient     | 3. Dialysis                     |
| S. Activity coefficient      | 4. Centrifugation               |
- c) Define Biomolecule? List the characteristics of biomolecule. 2
- d) Discuss the various method of protein precipitation. 5

Q2.

- a) Which of the following is not a method of cell disruption? 1
- i) Sonication
  - ii) Homogenization
  - iii) Streaking
  - iv) Chemical Treatment
- b) Which of the following technique uses sound waves for cell disruption? 1
- i) Homogenization
  - ii) Sonication
  - iii) Blender
  - iv) Mortar and Pestle
- c) Define any two of the following terms below briefly: 3
- i) Filtration
  - ii) Dialysis
  - iii) Ultrafiltration
- d) List any two cell disruption method. Describe any one cell-disruption technique 5

Q3.

- a) Arrange following separation techniques in ascending order based on size range of filtration capacity (from smallest to largest). 2
- (i) ultracentrifugation (ii) Sand filter (iii) microfiltration (iv) dialysis 3
- b) Differentiate between Reverse Osmosis and Osmosis. 5
- c) Define upstream and downstream processing with suitable example.

Q4.

- a) Define centrifugation. 2
- b) What is the applied centrifugal field at a point equivalent to 3 cm from the centre of rotation and an angular velocity of  $2000 \text{ rad s}^{-1}$ ? 3
- c) What is distillation? Elaborate working principal of any two of the following: 5

P.T.O.

(2)

- i) Fractional distillation                      ii) Steam distillation  
 iii) Vacuum distillation

Q5.

- a) Ni-NTA Agarose is a type of ----- chromatography for purifying recombinant proteins carrying a His tag. 1  
 i) Affinity    iii) HPLC  
 ii) gel permeation                                  iv) ion-exchange
- b) Explain ion exchange chromatography. List its applications. 4
- c) Draw a schematic of HPLC and explain its working principal. 5

Q6.

- a) Define the following terms below briefly: 2  
 i) Absorption  
 ii) Adsorption
- b) Explain the principal of liquid-liquid extraction? 3
- c) A solute has a KD between water and chloroform of 5.00. Suppose we extract a 50.0 ml sample of a 0.050 M aqueous solution of the solute using 15.00 mL of chloroform. 5  
 (i) What is the separation's extraction efficiency?  
 (ii) What volume of chloroform do we need if we wish to extract 99.9% of the solute?

Q7.

- a) Which of the following microorganism is used for the production of citric acid 1  
 i) *Saccharomyces cerevisiae*  
 ii) *Lactobacillus bulgaricus*  
 iii) *Streptococcus lactis*  
 iv) *Aspergillus niger*
- b) Explain principal of crystallization? List its application in biotechnology. 4
- c) Draw schematic of citric acid production process and explain each processing steps briefly. 5  
 Also, list the application of citric acid.