

**DOWNSTREAM PROCESSING
(BIOT 6133)**

Time Allotted : 2½ hrs

Full Marks : 60

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 4 (four) from Group B to E, taking one from each group.*

Candidates are required to give answer in their own words as far as practicable.

Group – A

1. Answer any twelve:

12 × 1 = 12

Choose the correct alternative for the following

- (i) The most common ion-exchange resin used in a aqueous two phase extraction is
(a) Polyvinyl difluoride (b) polyethylene glycol
(c) Polysulfone (d) Polytetrafluoroethylene.
- (ii) Proteins are separated in the SDS-PAGE according to their
(a) charge (b) hydrophobicity
(c) size (d) polarity
- (iii) Which of the following organism is used for ethanol production?
(a) *S. cerevisiae* (b) *E. coli*
(c) *Vibrio cholera* (d) *K. fragillis*
- (iv) Which of the following should be used for the first step of purification of protein from a complex mixtures?
(a) Precipitation
(b) Ion exchange chromatography
(c) Affinity chromatography
(d) Hydrophobic interaction chromatography
- (v) Membrane used in U F is of the type
(a) symmetric (b) isotropic (c) anisotropic (d) asymmetric
- (vi) Non-mechanical method of cell disruption include
(a) French press (b) Bead mill
(c) Ball mill (d) Osmotic shock
- (vii) Basic principle of centrifugation depends on
(a) concentration gradient (b) velocity gradient
(c) centrifugal force (d) pressure gradient

- (viii) Molecular weight of a protein can be determined by
 (a) size exclusion chromatography (b) ion-exchange chromatography
 (c) pseudo--affinity chromatography (d) affinity chromatography.
- (ix) At due point D B T (dry bulb temperature) and W B T (wet bulb temperature) will be
 (a) D B T > WBT (b) DBT < WBT
 (c) D B T = W B T (d) no relation between DBT and WBT
- (x) Dimension of specific heat is defined as
 (a) kal/kg °C (b) kg/kal ° C
 (c) kg °C /kal (d) kal °C /kg.

Fill in the blanks with the correct word

- (xi) If $C_w / C_b = 10$ concentration polarization is ----- .
 [C_w is solute concentration at membrane surface, C_b is bulk solute concentration]
- (xii) In case of sedimentation Reynold's number for spherical particles is -----.
- (xiii) Dimension of enthalpy is -----.
- (xiv) The relative sizes of the faces of a crystal in a particular system can vary considerably, resulting in a variety of crystal shapes. This variation is called a modification of -----.
- (xv) It is often recommended that geometric similarity and constant power per volume be used in scale-up of crystallizers $P/V =$ -----.

Group - B

2. (a) Define cell lysis. [[CO1](Remember)/LOCQ]]
 (b) Explain in brief the chemical method of cell lysis. [[CO1](Remember)/LOCQ]]
 (c) Write in brief prokaryotic cell wall structure. [[CO1](Remember)/IOCQ]]
2 + 5 + 5 = 12
3. (a) How much frequency is used in sonication for cell lysis? [[CO1](Remember)/LOCQ]]
 (b) Explain the operation of high pressure cell homogenizer with the help of a clean diagram. [[CO1](Remember)/LOCQ]]
2 + 10 = 12

Group - C

4. (a) What do you understand by the term concentration polarization? [[CO2](Remember)/LOCQ]]
 (b) With the help of a schematic diagram explain the boundary layer in cross flow filtration with a dissolved solute in the feed. [[CO2](Remember)/LOCQ]]
 (c) Explain the function of HEPA filters and where it is used? [[CO2](Analyse)/IOCQ]]
 (d) With the help of a clean diagram define membrane fouling. [[CO2](Analyse)/IOCQ]]
2 + 5 + 2 + 3 = 12

5. (a) Define extraction. [[CO3]Remember/LOCQ]
 (b) What do you understand by the term partition coefficient? [[CO3](Remember)/IOCQ]
 (c) A counter current extractor with four equilibrium stages is available for separating a desired bio-product from a contaminating impurity, which is 10 % of the weight of the bio-product in a feed stream. For the extraction solvent being used, which is immiscible with the feed stream, the bio-product has a partition coefficient, $K = 10$, while the impurity has $K = 1$. For an S/F ratio of 0.2, what will be the ratio of impurity to bio-product in the extract phase at the outlet of the extractor? [[CO3](Evaluate)/HOCQ]
2 + 2 + 8 = 12

Group - D

6. (a) Explain in brief the basic mathematical relations used for the scale-up of the crystallizer. [[CO6](Analyse)/LOCQ]
 (b) It is desired to scale-up a batch crystallization of an antibiotic based on experiments with a one litre crystallizer. The use of a 3-cm diameter impeller at a speed of 800 rpm led to good crystallization results. For maintaining power per volume constant upon scale-up to 300 litre, what should be the diameter and speed of the large scale impeller? The solvent has the same density and viscosity as of water. [[CO6](Evaluate)/HOCQ]
6 + 6 = 12
7. Write notes on : - any three
 H P L C , Hydrophobic interaction chromatography, Ion exchange chromatography and size exclusion chromatography [[CO4](Remember)/LOCQ]
(3 × 4) = 12

Group - E

8. (a) What do you understand by the term “Baker’s yeast”? [[CO5](Analyse)/HOCQ]
 (b) Explain the commercial importance of “Baker’s yeast”. [[CO4](Remember)/LOCQ]
 (c) Which raw materials is used for “baker’s yeast” production? [[CO4](Remember)/IOCQ]
 (d) How do you separate “Baker’s yeast” after fermentation? [[CO4](Remember)/IOCQ]
2 + 2 + 2 + 6 = 12
9. (a) What do you understand by the term Recombinant protein? [[CO5](Analyse)/LOCQ]
 (b) Explain the medical use of Recombinant protein. [[CO5](Remember)/LOCQ]
 (c) Describe purification steps required to purify recombinant protein. [[CO5](Apply)/IOCQ]
3 + 3 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	56.25	27.08	16.67

