

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2025

B.Tech.- VI Semester (Biotechnology)

COURSE CODE (CREDITS): 18B11BT611 (04)

MAX. MARKS: 35

COURSE NAME: Downstream Processing

COURSE INSTRUCTORS: Dr. Saurabh Bansal

MAX. TIME: 2 Hours

Note: (a) All questions are compulsory.

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

Q. No	Question	CO	Marks
Q1 a)	Which enzyme is used to lyse the fungal cells?	CO-2	1
Q1 b)	Which key factors, including sample properties and operational conditions, determine the efficiency of centrifugation? Discuss how each factor affects the sedimentation and separation of particles during the process.	CO-2	3
Q2	Differentiate between the following:	CO-3	
Q2 a)	Liquid-Liquid Extraction and Adsorption		2
Q2 b)	HPLC and FPLC		2
Q3	Cells of the fall armyworm <i>Spodoptera frugiperda</i> are cultured in a fermenter to produce viral particles for insecticide. Viral particles are released into the culture broth after lysis of the host cells. The initial culture volume is 5 litres. An aqueous two-phase polymer solution of volume 2 litres is added to this liquid; the volume of the bottom phase is 1 litre. The virus partition coefficient is 10^{-2} . Write a mass balance for viral particles in terms of concentrations and volumes of the phases, equating the amounts of virus present before and after the addition of polymer solution.	CO-4	2
Q4	A pilot-scale gel chromatography column packed with Sephacryl resin is used to separate two hormones, A and B. The column is 5 cm in diameter and 0.3 m high; the void volume is $1.9 \times 10^{-4} \text{ m}^3$. The water regain value of the gel is $3 \times 10^{-3} \text{ m}^3 \text{ kg}^{-1}$ dry Sephacryl; the density of wet gel is $1.25 \times 10^3 \text{ kg m}^{-3}$. The partition coefficient for hormone A is 0.38; the partition coefficient for hormone B is	CO-4	3

	0.15. If the eluant flow rate is 0.7 l h^{-1} , what is the retention time for each hormone?		
Q5 a)	How will the height of distribution planes in chromatography affect the separation of multiple proteins and the resolution of the peaks?	CO-5	2
Q5 b)	Suppose you have two columns, A & B, with a length of 5 cm and 25 cm, respectively. Both columns have the same diameters. Which column will you use for the separation of proteins via size exclusion chromatography? Also, give the justification for your answer.	CO-5	2
Q5 c)	Suppose you have a protein mixture containing 5 different proteins, A, B, C, D and E. The isoelectric points for these proteins are 6.0, 6.0, 7.0, 8.0 and 7.0, respectively. Proteins A and E have a molecular weight of 200 kDa, whereas Proteins C & D have 150 kDa and Protein B has 50 kDa. Design an experimental strategy to purify each protein efficiently using the minimum number of steps. Also, give the justification for each chosen purification method.	CO-5	3
Q6 a)	What is the importance of formulation in ensuring the stability and efficacy of bioproducts after downstream processing?	CO-6	2
Q6 b)	What role do surfactants play in bioproduct stabilization? How can improper surfactant selection negatively impact product integrity?	CO-6	2
Q7 a)	Provide two examples of each of the commonly used strains for gluconic acid and alcohol production.	CO-6	2
Q7 b)	How does pH regulation affect citric acid accumulation in fermentation? Why is acidic pH preferred for maximum yield?	CO-6	2
Q7 c)	Explain the role of the glyoxylate cycle in citric acid production. Why is citric acid not considered a primary metabolite?	CO-6	3
Q8	What are the advantages of microbial lactic acid production over chemical synthesis?	CO-6	2
Q9	Outline the key steps involved in the downstream processing of penicillin.	CO-6	2