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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATIONS- 2026

B.Tech-VI Semester (BT)

COURSE CODE (CREDITS): 18B11BT611 (4) 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.

(c) Use of calculator is allowed.

Q. No.	Question	CO	Marks
Q1 a)	Outline the industrial process used for the production of 6-APA (6-aminopenicillanic acid), highlighting the main steps involved.	2	[3]
Q1 b)	Identify the precursor compounds required for the industrial synthesis of penicillin V and penicillin G.	2	[2]
Q1 c)	What are the key limitations associated with naturally occurring penicillin?	2	[1]
Q1 d)	During which metabolic phase—trophophase or idiophase—is penicillin biosynthesis carried out?	2	[1]
Q1 e)	How does the penicillin inhibit the bacterial growth?	2	[1]
Q2	Differentiate between		
Q2 a)	HPLC and FPLC	3	[2]
Q2 b)	IEC and HIC	3	[2]
Q3	In aqueous two-phase extraction, if partition coefficient =2, and if the total concentration of the protein is 3.0 mM in 350 L, calculate the concentration in the top phase if the extraction efficiency is 90% and volume of liquid in the lower phase is 100 L.	4	[2]
Q4 a)	Protein A has a molecular weight of 80 kDa and is hydrophilic, while Protein B has a molecular weight of 10 kDa and is hydrophobic. Which protein will elute first from a Gel Permeation Chromatography column, and what is the underlying principle that explains this behavior?	4	[3]

Q4 b)	You are provided with two columns—Column A (5 cm length) and Column B (10 cm length)—both packed with identical Sephadex resins. Which column will deliver better resolution, and what is the scientific reasoning behind this difference?	4	[2]
Q4 c)	Gel chromatography is to be used for commercial-scale purification of a proteinaceous diphtheria toxoid from *Corynebacterium diphtheriae* supernatant. In the laboratory, a small column of 2 cm inner diameter and height 0.4 m is packed with 10 g dry Sephadex gel; the void volume is measured as 23 ml. A sample containing the toxoid and impurities is injected into the column. At a liquid flow rate of 14 ml min^{-1}, the elution volume for the toxoid is 50 ml; the elution volume for the principal impurity is 30 ml. Which is the larger molecule, the diphtheria toxoid or the principal impurity?	4	[1]
Q4 a)	Why is industrial lactic acid production via fermentation considered more desirable compared to other methods?	5	[2]
Q4 b)	What specific benefits does lactic acid production using *Rhizopus oryzae* offer over bacterial fermentation processes?	5	[2]
Q4 c)	What are the major advantages of employing *Zymomonas mobilis* instead of yeast in industrial alcohol production?	5	[3]
d)	During alcohol downstream processing, which organic solvent is utilized to form a ternary azeotrope mixture?	5	[1]
Q5 a)	Why is it necessary to develop different formulations of bioproducts? State four major reasons.	6	[2]
Q5 b)	Suppose your purified protein product is highly sensitive to oxidation. How would you address this issue during the formulation process?	6	[2]
Q6	Draw a self-explanatory flow chart for the downstream processing of Citric acid.	6	[3]