U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

January 2024 Semester End Main Examinations

Programme: B.E. **Semester: VII**
Branch: Chemical Engineering **Duration: 3 hrs.**
Course Code: 19CH7DCBCE **Max Marks: 100**
Course: Biochemical Engineering

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	CO	PO	Marks
1	a)	How are the bacteria differentiated? Draw the schematic of bacteria and label.	CO1	PO2	5
	b)	Differentiate between the prokaryotes and eukaryotes.	CO1	PO2	6
	c)	Explain the structure and typical properties of nucleotides.	CO2	PO2	9
		UNIT - II			
2	a)	With the help of kinetic models, describe the mechanism of enzymatic reactions.	CO5	PO4	6
	b)	How are the proteins formed? Explain the structure of proteins based on amino acids with their features and suitable examples.	CO4	PO2	6
	c)	The initial rate of enzyme-catalyzed reaction at various substrate concentrations are as tabulated.	CO5	PO4	8

$S\times 10^4$ mol/L	41	9.5	5.2	1.03	0.49	0.106	0.051
$v\times 10^4$ mol/L min	177	173	125	106	80	67	43

Evaluate the MM constants using the Lineweaver Burk Plot.

		OR			
3	a)	Derive the rate equation for a single substrate enzyme catalyzed reaction using the Brigg's-Halden approach. State the assumptions made.	CO5	PO4	10

3	b)	The following data have been obtained for two different initial enzyme concentrations (Case 1 and Case 2) for an enzyme–catalyzed reaction. Evaluate Michaelis-Menten constants and turn over numbers using the Langmuir plot Method. Case 1: $[E]_0$ = 0.021 g/L [S], g/L: 20, 10, 6.7, 5, 3.2, 2.9, 2.5 v, g/L min: 1.14, 0.87, 0.7, 0.59, 0.44, 0.39, 0.35 Case 2: $[E]_0$ = 0.00935 g/L [S], g/L: 20, 10, 6.7, 5, 4.4, -, - v, g/L min: 0.67, 0.51, 0.41, 0.34, 0.29, -, -	***CO5***	***PO4***	**10**
		UNIT - III			
4	a)	Explain the mechanism of uncompetitive inhibition. Derive the expression for uncompetitive inhibition.	***CO4***	***PO2***	**10**
	b)	A pesticide inhibits the activity of a particular enzyme E, which can be therefore employed to determine the presence of an inhibitor in an unknown sample. During the assay in the lab, the following data is obtained. [S], mol /L: 0.00033, 0.0005, 0.00067, 0.00165, 0.00221 No inhibitor v, mol/L min: 56, 71, 88, 129, 149 With inhibitor v, mol/L min: 37, 47, 61, 103, 125 i. Is the pesticide competitive or non-competitive? ii. Find V_{max} , K_M *and* K_I	***CO5***	***PO4***	**10**
		OR			
5	a)	What is meant by reversible noncompetitive inhibition? Explain the mechanism during inhibition and also show that Rate of the reaction, $V = V_{max\ app}[S]/[K'_M + [S]\ ]$ State the assumptions made.	***CO5***	***PO4***	**10**
	b)	What is the significance of immobilizing enzymes? Explain kinetics of immobilization with diffusional limitations.	***CO4***	***PO2***	**10**
		UNIT - IV			
6	a)	Derive an equation for the biomass production in a chemostat. Deduce the equation starting from the substrate balance to find the maximum specific growth rate of biomass.	***CO3***	***PO4***	**10**
	b)	A new strain of yeast is being considered for biomass production. The following data were obtained using a chemostat.	***CO3***	***PO4***	**10**

			An influent substrate concentration of 800mg/L and an excess of oxygen were used at a pH of 5.5 and T=35℃ . Using the following data, calculate K_d and $Y^M_{X/S}$. Dilution rate: 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 Carbon concentration, mg/L: 16.7 | 33.5 | 59.4 | 101 | 169 | 298 | 702 Cell concentration, mg/L: 366 | 407 | 408 | 404 | 371 | 299 | 59			
			UNIT - V			
	7	a)	Explain the mechanism of affinity chromatography. What are the limitations and applications of bio-affinity chromatography?	***CO6***	***PO7***	**6**
		b)	Discuss different reactor designs used in the fermentation industry.	***CO3***	***PO4***	**7**
		c)	What is the importance of cell disruption and freeze-drying in the bioprocess industry? Explain the methods of cell disruption and working principle of freeze drying.	***CO6***	***PO7***	**7**

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