U.S.N.										

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

Autonomous Institute Affiliated to VTU

January / February 2025 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)	With neat diagram, explain the structure of prokaryotic and eukaryotic cells.	CO1	PO2	**06**
	b)	Explain the structure of bacteria. Discuss the process of gram reaction to bacteria with suitable examples.	CO1	PO2	**08**
	c)	What are the monomers involved in the Deoxyribonucleic acid polymer? Explain the double helix of a Deoxyribonucleic acid.	CO2	PO2	**06**
		OR			
2	a)	Brief about the significance of bioprocess engineering and give its application in various domain.	CO1	PO2	**08**
	b)	Explain in detail the classification of microorganisms.	CO1	PO2	**12**
		UNIT - II			
3	a)	Explain how enzyme catalyzed reaction is different from chemical reaction? Describe the dependency of enzyme functionality with respect to pH, temperature and shear force.	CO4	PO2	**10**
	b)	When glucose is converted to fructose by glucose isomerase, the slow product formation step is also reversible as: $S + E \leftrightarrow ES$; where the rate constants are k_1 and k_2 respectively $ES \leftrightarrow P + E$; here the rate constants are k_3 and k_4 respectively Derive the rate equation considering Michaelis Menten and Briggs Haldane methods.	CO5	PO4	**10**
		OR			

	4	a)	Explain the enzyme substrate complexion for the enzyme catalyzed reaction. How does it leads to the basic expression for rate of enzyme catalyzed reaction?	*CO5*	*PO4*	**8**
		b)	The data obtained for two different enzyme concentration for enzyme catalyzed reaction: Using Hanes-Woolf method, find i) k_M ii) Maximum rate for two different initial enzyme concentration.	*CO5*	*PO4*	**12**

Rate when E_0 = 0.015 g/L	Substrate concentration in g/L	Rate When $E_0 = 8.75 \times 10^{-3}$ g/L
1.14	20.0	0.67
0.87	10.0	0.51
0.7	6.7	0.41
0.59	5.0	0.34
0.5	4.0	0.29
0.44	3.3	-
0.39	2.9	-
0.35	2.5	-

		UNIT - III			
5	a)	From equilibrium approach, show that in the competitive enzyme inhibition the rate constant gets changed due to presence of inhibitors.	*CO5*	*PO4*	**08**
	b)	In the following reaction of enzyme and substrate in presence of inhibitor, determine the rate expression for product formation. $E + S \overset{K_M}{\leftrightarrow} ES \overset{K2}{\rightarrow} E + P$ $E + I \overset{KI}{\leftrightarrow}$ EI + S $\leftrightarrow ESI$ $ES + I \overset{KM}{\leftrightarrow}$ ESI	*CO5*	*PO4*	**12**
		OR			
6	a)	The initial reaction rate of hydrolysis of a substrate by enzyme in absence and presence of inhibitor of 1.5×10^{-7} mol/L and the following data is obtained:	*CO5*	*PO4*	**12**

S mol/L	Initial reaction rate (no inhibitor)	Initial reaction rate(Inhibitor)
0.0032	0.111	0.059
0.0049	0.148	0.071
0.0062	0.143	0.091
0.0080	0.166	0.111
0.0095	0.2	0.125

			i. Is it a case of competitive or non-competitive inhibition? ii. Evaluate Michaelis Menten kinetic parameters in the presence of inhibitor by Langmuir Plot.			
		b)	Explain the chemical method for enzyme immobilization.	*CO4*	*PO2*	**08**
			UNIT - IV			
	7	a)	Explain the details of Monod growth kinetics. Also explain wash out in the said growth kinetics.	*CO5*	*PO4*	**10**
		b)	With a neat illustration, demonstrate the phases of cell growth.	*CO3*	*PO4*	**04**
		c)	Derive that the cell number doubling time is inversely proportional to the specific growth rate.	*CO3*	*PO4*	**06**
			OR			
	8	a)	Derive the expression to obtain for specific growth rate at maximum cell output.	*CO3*	*PO4*	**14**
		b)	What is washout condition in growth kinetics? Explain.	*CO3*	*PO4*	**6**
			UNIT - V			
	9	a)	Explain with diagram, the operation of stirred tank aseptic fermenter.	*CO6*	*PO7*	**10**
		b)	Explain the following downstream operations: i) Freeze drying ii) Affinity chromatography	*CO6*	*PO7*	**10**
			OR			
	10	a)	Elaborate on aseptic aerobic fermenter operation.	*CO6*	*PO7*	**10**
		b)	Brief on medium formulation in bioreactor.	*CO6*	*PO7*	**05**
		c)	Explain the cell disruption using French press.	*CO6*	*PO7*	**05**

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