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

Autonomous Institute Affiliated to VTU

February / March 2023 Semester End Main Examinations

Programme: B.E. **Semester: VII**
Branch: Chemical Engineering **Duration: 3 hrs.**
Course Code: 19CH7DCBCE **Max Marks: 100**
Course: Biochemical Engineering **Date: 04.03.2023**

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

UNIT - I

1 a) Discuss the role of chemical engineers in bioprocess industries. **06**

b) Classify microorganisms based on structure and mention their characteristics. **10**

c) How does the structure of nucleic acids play a role in the biological functions? **04**

UNIT - II

2 a) Based on I.C., classify the enzymes along with functional groups and specific reactions under each category. **10**

b) Develop a MM kinetic model using equilibrium approach. State all the assumptions made. Draw the concentration plot and MM plot. **10**

OR

3 a) Discuss the effect of pH and temperature on the rates of enzyme catalyzed reaction. Draw the profiles. **10**

b) The hydration of carbon dioxide is catalyzed by carbonic anhydrase as follows. **10**

$$H_2O + CO_2 \leftrightarrow HCO_3^- + H^+$$

The following data were obtained for the forward and reverse reaction rates at pH 7.1 and an enzyme concentration of 2.8×10^{-9} M.

Hydration		Reverse reaction	
1/V (M^{-1}/s)	[CO_2] (M)	1/V (M^{-1}/s)	[HCO_3^-] (M)
0.036	0.00125	0.095	0.002
0.02	0.0025	0.045	0.005
0.12	0.005	0.029	0.01
0.06	0.02	0.025	0.015

Calculate the forward and backward catalytic constants and MM constants.

UNIT - III

4 a) Develop a model for uncompetitive inhibition and state all assumptions. Draw the plots also. **10**

b) Define substrate inhibition and derive the model for the same. State all assumptions and draw the plot. **10**

OR

5 a) Discus the various methods of enzyme immobilization in detail. **12**

b) An inhibitor is added to an enzymatic reaction at a level of 1.0 g/L. The following data were obtained for K_M = 9.2 g of substrate/L. **08**

V (L/min)	0.909	0.658	0.493	0.400	0.333	0.289	0.227
S (g/L)	20.00	10.00	6.67	5.00	4.00	3.33	2.50

i. Is the inhibitor competitive or non-competitive?

ii. Find the value of K_I?

UNIT - IV

6 a) Discuss the various type of inhibition along with model equations under growth inhibitors. **10**

b) Develop a model for a chemostat at which the dilution rate is equal to specific growth rate from the basic fundamental mass balance. **10**

UNIT - V

7 a) With a neat sketch, explain the various alternate bioreactors along with merits and limitation. **12**

b) Discuss the different types of cell disruption techniques. **08**

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