Code No: RR410807 **Set No. 1**

IV B.Tech I Semester Supplementary Examinations, March 2006
BIO-CHEMICAL ENGINEERING
(Chemical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Compare and contrast the general characteristics of procaryotes and eucaryotes. [16]

2. (a) Eadie (1942) measured the initial reaction rate of hydrolysis of acetyl-choline (substrate) by dog serum (source of enzyme) and obtained the following data:

Substrate concentration mmol/L	Initial reaction rate mmol/L min
0.0032	0.111
0.0049	0.148
0.0062	0.143
0.0080	0.166
0.0095	0.200

Evaluate the Michealis-Menten kinetic parameters by employing the Lineweaver-Burk plot.

(b) Briefly discuss the other two methods for estimating the Michealis-Menten parameters. [12+4]

3. Give a detailed account of the effect of pH and temperature on enzyme activity. [16]

4. What are the various methods of immobilization of enzymes? Discuss in detail. [16]

5. Discuss in detail about synthesis of small molecules. [16]

6. With the help of typical growth curve, discuss in detail growth cycle phases for batch cultivation and suggest ways of reducing lag times. [16]

7. (a) Describe the various configurations of CSTRs used for enzyme-catalyzed reactions.

(b) Derive the general substrate balance equation for the single enzyme catalyzed reaction S $\rightarrow$ P taking place in a CSTR. [10+6]

8. Write short notes on production of

(a) Antibiotics

(b) Ethanol [8+8]

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Code No: RR410807 **Set No. 2**

IV B.Tech I Semester Supplementary Examinations, March 2006
BIO-CHEMICAL ENGINEERING
(Chemical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What are spirilla, cocci and bacilli? Draw a neat diagram to represent them.
   (b) What are procaryotes? Describe their general characteristics with a neat sketch.
   (c) What is the difference between mitochondria and chloroplast? [6+6+4]

2. (a) From a series of batch runs with a constant enzyme concentration, the following initial rate data were obtained as a function of initial substrate concentration.

Substrate concentration mmol/L	Initial reaction rate mmol/L min
1	0.20
2	0.22
3	0.30
5	0.45
7	0.41
10	0.50
15	0.40
20	0.33

   Evaluate the Michealis-Menten kinetic parameters by employing the Lineweaver-Burk plot.
   (b) Discuss the strengths and weaknesses of the above method. [12+4]

3. Decarboxylation of glyoxalate (S) by mitochondria is inhibited by malonate (I). Using the following data obtained in batch experiments, determine the following:

Glyoxal,S (mM)	Rate of CO_2 evolution, v (mmoles/L.h)		
	I = 0	I = 1.26 mM	I = 1.95 mM
0.25	1.02	0.73	0.56
0.33	1.39	0.87	0.75
0.40	1.67	1.09	0.85
0.50	1.89	1.30	1.00
0.60	2.08	1.41	1.28
0.75	2.44	1.82	1.39
1.00	2.50	2.17	1.82

(a) What type of inhibition is this?

(b) Determine the kinetic constants. [10+6]

4. Compare the important characteristics of physical adsorption and covalent bonding. [16]

5. (a) Describe passive and facilitated diffusion with a neat figure.

   (b) Give an account of active transport with the help of a schematic diagram. Discuss briefly its applications. [8+8]

6. With the help of typical growth curve, discuss in detail growth cycle phases for batch cultivation and suggest ways of reducing lag times. [16]

7. What is the effect of recycle and wall growth in a CSTR cell reactor. Explain in detail. [16]

8. Name the microorganism used for citric acid production. What is the basis for commercial biochemical citric acid process? Briefly explain the citric acid recovery process with a neat flow diagram. [16]

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Code No: RR410807 **Set No. 3**

IV B.Tech I Semester Supplementary Examinations, March 2006
BIO-CHEMICAL ENGINEERING
(Chemical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Discuss in detail about protein structure. [16]

2. Suppose that an enzyme has two active sites so that substrate is converted to product via the reaction sequence

$$E + S \underset{k_1}{\overset{k_1}{\rightleftharpoons}} (ES)$$

$$(E + S) + S \underset{k_2}{\overset{k_2}{\rightleftharpoons}} (ESS)$$

$$(ESS) \xrightarrow{k_3} (ES) + P$$

$$(ES) \xrightarrow{k_4} E + P$$

Derive a rate expression for P formation by assuming quasi-steady-state for (ES) and for (ESS). [16]

3. Eadie (1942) measured the initial reaction rate of hydrolysis of acetyl-choline (substrate) by dog serum (source of enzyme) in the absence and presence of prostigmine (inhibitor), 1.5 x 10^{-7} mol/L and obtained the following data:

Substrate concentration mol/L	Initial reaction rate (mol/L.min)	
	Absence of prostigmine	Presence of prostigmine
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	0.200	0.125

   (a) Is the prostigmine competitive or noncompetitive inhibitor?

   (b) Evaluate the Michealis-Menten kinetic parameters in the presence of inhibitor by employing the Lineweaver-Burk plot. [8+8]

4. (a) What does immobilization of enzymes mean? Give the various reasons for immobilization.

   (b) Discuss in detail the physical methods of immobilization. [4+12]

5. (a) State the two distinguishing characteristics of active transport and give its applications briefly.
   (b) Thermodynamic considerations show that passive diffusion is spontaneous. Prove this statement. What will the free energy change be equal to if the component being transferred is charged?
   (c) State the characteristic features of facilitated diffusion. [8+4+4]

6. With the help of typical growth curve, discuss in detail growth cycle phases for batch cultivation and suggest ways of reducing lag times. [16]

7. Write short notes on
   (a) Alternate bioreactor configurations
   (b) Medium formation [8+8]

8. (a) Give a brief account of air sterilization and mention the characteristics of membrane filters used for this purpose.
   (b) Explain continuous sterilization of media with suitable diagrams. [8+8]

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Code No: RR410807 **Set No. 4**

IV B.Tech I Semester Supplementary Examinations, March 2006
BIO-CHEMICAL ENGINEERING
(Chemical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) With the help of neat figure show the condensation of several nucleotides to form a chain linked by phosphodiester bonds.
   (b) Write about the characteristic features of DNA molecules. [6+10]

2. (a) The enzyme, fumarase, has the following kinetic constants:

   $S + E \underset{k_1}{\overset{k_1}{\rightleftharpoons}} (ES)$ $(ES) \xrightarrow{k_2} P + E$

   Where
   $k_1 = 10^9 M^{-1}s^{-1}$
   $k_1 = 4.4 \text{ x } 10^4 s^{-1}$
   $k_2 = 10^3 s^{-1}$

   i. What is the value of the Michealis constant?
   ii. At an enzyme concentration of 10^{-6}M. What will be the initial rate of product formation at a substrate concentration of 10^{-3} M?

   (b) What are the three qualitative features exhibited by the Michealis-Menten equation?
   (c) How can we determine the Michealis-Menten parameters directly from the v versus S data? Explain with the help of a figure. [8+3+5]

3. Eadie (1942) measured the initial reaction rate of hydrolysis of acetyl-choline (substrate) by dog serum (source of enzyme) in the absence and presence of prostigmine (inhibitor), 1.5 x 10^{-7} mol/L and obtained the following data:

Substrate concentration mol/L	Initial reaction rate (mol/L.min)	
	Absence of prostigmine	Presence of prostigmine
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	0.200	0.125

   (a) Is the prostigmine competitive or noncompetitive inhibitor?
   (b) Evaluate the Michealis-Menten kinetic parameters in the presence of inhibitor by employing the Lineweaver-Burk plot. [8+8]

4. (a) Name at least three materials used for enzyme immobilization by
   i. Physical adsorption and
   ii. Ionic binding
   (b) Discuss about various physical methods used for enzyme immobilization.[6+10]

5. (a) State the two distinguishing characteristics of active transport and give its applications briefly.
   (b) Thermodynamic considerations show that passive diffusion is spontaneous. Prove this statement. What will the free energy change be equal to if the component being transferred is charged?
   (c) State the characteristic features of facilitated diffusion. [8+4+4]

6. With the help of typical growth curve, discuss in detail growth cycle phases for batch cultivation and suggest ways of reducing lag times. [16]

7. (a) Describe the various configurations of CSTRs used for enzyme-catalyzed reactions.
   (b) Derive the general substrate balance equation for the single enzyme catalyzed reaction S $\rightarrow$ P taking place in a CSTR. [10+6]

8. (a) Give a brief account of air sterilization and mention the characteristics of membrane filters used for this purpose.
   (b) Explain continuous sterilization of media with suitable diagrams. [8+8]

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