

III B.Tech II Semester Regular Examinations, Apr/May 2008
BIO CHEMICAL ENGINEERING
(Chemical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

1. (a) State the cell theory proposed by Schleiden and Schwann. What is its importance?
(b) Give an account of molds and yeasts. [6+10]
2. Define non-competitive inhibition and calculate the concentration of a non competitive inhibitor needed to yield a 90% inhibition of an enzyme catalyzed reaction? (where $K_i = 2.9 \times 10^{-4}$ M) [16]
3. (a) Name at least two natural supports and two synthetic supports used for immobilization by covalent attachment.
(b) Describe the methods of physical entrapment by poly acrylamide gel and microencapsulation. [4+12]
4. (a) Give the advantages and disadvantages of CSTR over batch reactor for measuring cell growth kinetics.
(b) Suppose you have a microorganism that obeys the Monod equation, where $\mu_{max} = 0.7 \text{ hr}^{-1}$ and $K_s = 5\text{g/L}$. The cell yield ($Y_{X/S}$) is 0.65. You want to cultivate this microorganism in one CSTR. The flow rate and the substrate concentration of the inlet stream should be 500L/h and 85 g/L, respectively. The substrate concentration of the outlet stream must be 5g/L. What should be the size of the fermenter? What is the cell concentration of the outlet stream? [8+8]
5. Give a detailed account of carbohydrates with suitable examples. [16]
6. (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]
7. (a) With the help of schematic diagram explain the steps involved in the transport of oxygen from a gas bubble to inside a cell.
(b) Write a brief note on determination of oxygen transfer rates by the sulfite oxidation method. [8+8]
8. Discuss in detail about the following solid-liquid separation processes.
(a) Filtration

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(b) Centrifugation.

[16]

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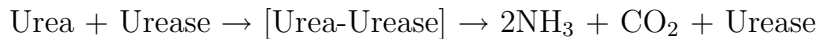
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1. (a) Sketch the diagram showing the kingdom of protists.
 (b) Describe the general features of bacteria and molds. [6+10]

2. Define the M-M parameters, and determine the V_{max} and K_m for the following reaction



The rate of reaction is a function of urea concentration from the following table

[C] urea, (kmol/L)	0.20	0.02	0.01	0.005	0.002
-r, urea (kmol/L.s)	1.08	0.55	0.38	0.20	0.09

[6+10]

3. What is Immobilization and describe the different types of Enzyme Immobilization? [16]
4. Describe the transient growth kinetics with a neat sketch, explain the phases of growth? [16]
5. Give a detailed account of carbohydrates with suitable examples. [16]
6. (a) Discuss in detail the salient features of an ideal plug flow reactor. Derive a design equation for an ideal plug flow reactor.
 (b) Compare and contrast CSTR and PFR used as a bioreactor. [10+6]
7. Discuss in detail the production of penicillin with a neat sketch and description. [16]
8. (a) Describe any two physical methods for cell rupture.
 (b) Discuss about chemical and biological methods for cell disintegration. [8+8]

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1. (a) Give the general characteristics of the following;
Cell wall, Plasma membrane, Endoplasmic reticulum.
- (b) Explain budding, sexual fusion, fission, sporulation, with a neat diagram. [6+10]

2. The initial rate of reaction for the enzymatic cleavage of deoxyguanosine triphosphate was measured as a function of initial substrate concentration as follows:

Substrate concentration μ mol/L	Initial reaction rate μ mol/(L.min)
6.7	0.30
3.5	0.25
1.7	0.16

- (a) Calculate the Michealis-Menten constants of the above reaction.
- (b) When the inhibitor was added, the initial reaction rate was decreased as follows:

Substrate μ mol/L	Inhibitor μ mol/L	Initial reaction rate μ mol/L.min
6.7	146	0.11
3.5	146	0.08
1.7	146	0.06

Is this competitive inhibition or non competitive inhibition? Evaluate the kinetic parameters. [8+8]

3. (a) With a simplified diagram, explain the Calvin cycle
- (b) Write short notes on macromolecule synthesis. [8+8]
4. Describe the various growth phases of batch cultivation and elucidate the different perspectives of cell population? [16]
5. Discuss in detail about carbohydrates with suitable examples. [16]
6. (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]
7. (a) Discuss about the different methods of scale up of bireactors.

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(b) Discuss in detail about power requirement of agitated vessels under non-aerated and aerated conditions. [8+8]

8. Describe the various methods available for cell rupture. [16]

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1. Name the twenty amino acids commonly found in proteins and explain how proteins are formed by condensation of aminoacids. Give the reactions involved. [16]
2. (a) What are the differences and similarities between enzymes and synthetic catalysts? Explain
(b) Give the classification of enzymes and the major classes of reactions that they catalyze. [8+8]
3. Describe the synthesis of glucose from pyruvate with the help of a figure showing the pathway. [16]
4. (a) Define dilution rate and yield coefficient based on biomass in a CSTR and establish that $D=F/V_R$
(b) Explain the environmental factors that affect the growth kinetics? [8+8]
5. What are carbohydrates? Explain in detail with examples. [16]
6. Write in detail about CSTR cell reactors with recycle and wall growth. [16]
7. (a) Discuss about continuous sterilization of media with neat schematic diagrams.
(b) Mention the advantages and drawbacks of continuous sterilization. [10+6]
8. Discuss in detail about the following solid-liquid separation processes.
(a) Filtration
(b) Centrifugation. [16]
