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Subject Code:- ABT0511

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: V - THEORY EXAMINATION (2024 - 2025)

Subject: Biochemical Reaction Engineering

Time: 3 Hours Max. Marks: 100

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.

2. Maximum marks for each question are indicated on right -hand side of each question.

3. Illustrate your answers with neat sketches wherever necessary.

4. Assume suitable data if necessary.

5. Preferably, write the answers in sequential order.

6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION-A 20

1. Attempt all parts:-

1-a. _____can be described as the power dependence of rate on the concentration of all reactants in a chemical reaction on the rate law expression.(CO1, K1) 1

(a) order of the reaction

(b) molecularity of the reaction

(c) rate constant

(d) none of these

1-b. Which of the following is the most suitable reactor for pharmaceutical industry? (CO1, K1) 1

(a) PFR

(b) Batch reactor

(c) PBR

(d) MBR

1-c. Select the appropriate factor on which catalytic efficiency of two distinct enzymes can be compared? (CO2, K1) 1

(a) Km

(b) Product formation

(c) Size of the enzymes

(d) pH of optimum value

1-d. Who proposed Induced fit model of an enzyme? (CO2, K1) 1

(a) Kuhne
(b) Koshland
(c) Payen
(d) Sumner

1-e. Which phase of growth kinetics is responsible for the production of secondary metabolites? (CO3,K1) 1

(a) Stationary phase
(b) Exponential phase
(c) Lag phase
(d) None of the above

1-f. _____ is an equation used in chemical kinetics to describe changes in the rate of a chemical reaction against temperature. (CO3, K1) 1

(a) Van't hoff equation
(b) Erying equation
(c) Arrhenius equation
(d) Monod equation

1-g. _____ is defined as the mass of product formed per unit mass of substrate consumed. (CO4, K1) 1

(a) product formation
(b) specific rate of product formation
(c) yield coefficient
(d) none of the above

1-h. _____ rate is defined as flow rate divided by volume of the bioreactor.(CO4, K1) 1

(a) volumetric rate
(b) plug flow rate
(c) dilution rate
(d) none of the above

1-i. Commensalism is an interaction in which one population is _____ affected by the presence of the other. (CO5, K1) 1

(a) negatively
(b) positively
(c) neutral
(d) none of the above

1-j. The classical model that describes oscillations in a prey-predator system is _____ model. (CO5, K1) 1

(a) Erying
(b) Monod

(c) Lotka-Volterra

(d) None of the above

2. Attempt all parts:-

2.a.	Compare zero, first, and second-order reaction with suitable example? (CO1, K2)	2
2.b.	Outline the process of determining enzyme efficiency. (CO2, K2)	2
2.c.	What is the significance of diauxic growth? (CO3, K1)	2
2.d.	Define residence time distribution? (CO4, K1)	2
2.e.	What do you understand by protocooperation? Give example. (CO5, K1)	2

SECTION-B 30

3. Answer any five of the following:-

3-a.	Explain Arrhenius law with suitable example? How does the activation energy and rate constant can be determined? (CO1, K2)	6
3-b.	How will you represent kinetic models for non-elementary reactions? (CO1, K1)	6
3-c.	Derive an equation for Lineweaver Burk plot using Michaelis-Menten equation? (CO2, K3)	6
3-d.	Explain the significance and applications of the Michaelis-Menten equation in enzyme kinetics? (CO2, K2)	6
3.e.	State the importance of mass transfer in microbial fermentation? (CO3, K1)	6
3.f.	Describe batch fermentation with respect to biodiesel production in detail? (CO4, K1)	6
3.g.	State any six industrial applications of mixed cultures? (CO5, K1)	6

SECTION-C 50

4. Answer any one of the following:-

4-a.	How will you interpret data in constant volume batch bioreactor using partial pressures? (CO1, K1,K2)	10
4-b.	Discuss in detail about the kinetic models for homogeneous reactions? (CO1, K2)	10

5. Answer any one of the following:-

5-a.	Explain the concept of enzyme immobilization in detail? Classify different methods of enzyme immobilization with their advantages and Disadvantages? (CO2, K2,K3)	10
5-b.	Derive an equation for solute concentration in an immobilized system for internal mass transfer following zero order kinetics? (CO2, K3)	10

6. Answer any one of the following:-

6-a.	Describe various characteristics of oxygen uptake in cells? What is the significance of critical oxygen tension? (CO3, K1)	10
6-b.	How will you describe the diffusion theory of transport phenomena in bioprocess system? (CO3, K1)	10

7. Answer any one of the following:-

7-a.	Describe the concept of residence time distribution with the help of diagram in CSTR? (CO4, K1)	10
7-b.	Why Solid state fermentation is considered to be the better mode of fermentation than submerged fermentation? Describe the working principle of plug flow bioreactor? (CO4, K1)	10

8. Answer any <u>one</u> of the following:-

8-a.	How would you describe the expressions for mutualistic growth in a mixed culture system? (CO5, K1)	10
8-b.	Describe the concept of Lotka-Volterra model in terms of microbial interaction? (CO5, K1)	10