



Name :

Roll No. :

Invigilator's Signature :

CS / B.TECH / CHE(NEW) / SEM-8 / CHE-802 / 2011
2011

BIOTECHNOLOGY & BIOCHEMICAL ENGINEERING

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

$$10 \times 1 = 10$$

i) The rate versus substrate concentration plot using Michaelis-Menten equation gives a

- a) section of a rectangle hyperbola
- b) section of a parabola
- c) straight line
- d) none of these.



- ii) Briggs-Halden theory is based on assumptions that are used in
- a) heterogeneous catalysis
 - b) homogeneous catalysis
 - c) both heterogeneous catalysis and homogeneous catalysis
 - d) none of these.
- iii) The Lineweaver and Burk plot gives an intercept on the abscissa equal to
- a) $1/K_m$
 - b) $-1/K_m$
 - c) $-K_m$
 - d) K_m .
- iv) In fully competitive type inhibition by a foreign inhibitor
- a) the inhibitor competes for the same site
 - b) the inhibitor is attached at different sites
 - c) the inhibitor is not attached at any site
 - d) the inhibitor and substrate react with each other.
- v) Plug flow bioreactor is a
- a) Steady state reactor
 - b) Unsteady state reactor
 - c) Reactor with high mixing
 - d) REactor with mixing in axial direction only.



- vi) Unit of the maximum specific cell growth rate is
- $(\text{concentration})^{-1} (\text{time})^{-1}$
 - $(\text{time})^{-1}$
 - Unitless
 - none of these.
- vii) In order to avoid wash out from a Mixed Flow Reactor, $k\tau_m$ should be
- $= 1$
 - > 1
 - < 1
 - none of these.
- viii) The best combination of reactors to achieve the substrate concentration at the maximum cell growth rate is
- MFR followed by PFR
 - PFR followed by MFR
 - Two MFRs in series
 - Two PFRs in parallel.
- ix) Filtration can only be carried
- by positive pressure drop driving force
 - by negative pressure drop driving force
 - both by positive and negative pressure drop driving forces
 - none of these.



- x) The terms 'stationary phase' and 'mobile phase' refer to
- a) Filtration
 - b) Chromatography
 - c) Membrane separation
 - d) Centrifugation.
- xi) Centrifugation is used to separate particles from liquid by
- a) centrifugal forces
 - b) gravity forces
 - c) both centrifugal and gravity forces
 - d) none of these.
- xii) For separation of biomolecules, which of the following membrane separation processes may be used ?
- a) Microfiltration
 - b) Ultrafiltration
 - c) Reverse osmosis
 - d) None of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. What is substrate saturation limit ? Explain how the rate of an enzymatic reaction depends on pH and temperature ?

1 + 2 + 2

3. What is fermentation ? Briefly describe its mechanism. 2 + 3



4. Define immobilization of enzyme. State the different methods of immobilization of enzyme techniques. 2 + 3
5. What is the importance of sterilization process in Biotechnology ? 5
6. Discuss the nature of Tertiary and Quaternary structures of protein. 5

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. Write short notes on any *three* of the following : 3 × 5
 - a) Significance of K_m (Michaelis constant)
 - b) Isozymes
 - c) Competitive Inhibition of an enzymatic reaction
 - d) Lock and Key Hypothesis.
8. a) Derive the expression for overall volumetric mass transfer coefficient in case of gas transfer through gas-liquid free surface. 10
 - b) Name all the factors that can affect overall volumetric mass transfer coefficient. Briefly describe effect of the factor 'ionic strength'. 5
9. a) Derive the expression for residence time distribution in a CSTR. 10
 - b) How are the 'Internal age distribution function' and the 'intensity function' related to unit step response of mixing ? 5



10. a) What are the main features of an allosteric enzyme ? Compare graphically the Michaelis-Menten enzyme kinetics and allosteric enzyme kinetics. 3 + 3
- b) Define specific activity of an enzyme. What is the unit of specific activity ? 2 + 2
- c) To measure the amount of glucoamylase in a crude enzyme preparation, 1 ml of the crude enzyme preparation containing 8 mg protein is added to 9 ml of a 4.44% starch solution. One unit of activity of glucoamylase is defined as the amount of enzyme which produces 1 μmol of glucose per min in a 4% solution of Lintner starch at pH 4.5 and at 60 °C. Initial rate of experiments show that the reaction produces 0.6 μmol of glucose/ml-min. What is the specific activity of the crude enzyme preparation ? 5
11. a) Derive the performance equation of a mixed flow reactor used for carrying out an enzymatic reaction following Michaelis-Menten equation. 7
- b) Substrate and enzyme flow through a mixed flow reactor ($V = 6$ litre). From the entering and leaving concentrations and flow rate find a rate equation to represent the action of the enzyme on the substrate :

C_{E0} mol/lit	C_{A0} ,mol/lit	C_A , mol/lit	V_0 , mol/lit
0.01	1.0	0.1	0.3
0.01	1.5	0.5	1.0
0.01	2.5	2.0	4.0

8



12. a) What is the difference between alcoholic fermentation and Baker's yeast fermentation ?
- b) What do you mean by micronutrients ? What are their physiological functions ?
- c) Enumerate the important types of chromatographic separations.

5 + 5 + 5

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