| | Utech |
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| Name: | |
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| Invigilator's Signature : | |

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.

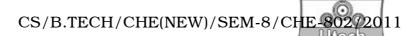
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- ii) Briggs-Halden theory is based on assumptions that are used in
 - a) heterogeneous catalysis
 - b) homogeneous catalysis
 - c) both heterogeneous catalysis and homogeneous catalysis
 - d) none of these.
- iii) The Lineweaver and Burk plot gives an intercept on the abscissa equal to
 - a) $1/K_m$

b) $-1/K_{\rm m}$

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
 - a) (concentration) $^{-1}$ (time) $^{-1}$
 - b) $(time)^{-1}$
 - c) Unitless
 - d) none of these.
- vii) In order to avoid wash out from a Mixed Flow Reactor, $k\tau_m \ \ \text{should be}$
 - a) = 1

b) > 1

c) < 1

- d) none of these.
- viii) The best combination of reactors to achieve the substrate concentration at the maximum cell growth rate is
 - a) MFR followed by PFR
 - b) PFR followed by MFR
 - c) Two MFRs in series
 - d) Two PFRs in parallel.
- ix) Filtration can only be carried
 - a) by positive pressure drop driving force
 - b) by negative pressure drop driving force
 - c) both by positive and negative pressure drop driving forces
 - d) none of these.

CS/B.TECH/CHE(NEW)/SEM-8/CHE-802/2011 The terms 'stationary phase' and 'mobile phase' refer to X) Chromatography Filtration b) a) Membrane separation d) Centrifugation. c) Centrifugation is used to separate particles from liquid xi) by centrifugal forces a) b) gravity forces both centrifugal and gravity forces c) none of these. d) xii) For separation of biomolecules, which of the following

- a) Microfiltration
- b) Ultrafiltration
- c) Reverse osmosis
- d) None of these.

GROUP - B

membrane separation processes may be used?

(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

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

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

- 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.
 - Name all the factors that can affect overall volumetric mass transfer coefficient. Briefly describe effect of the factor 'ionic strength'.
- 9. a) Derive the expression for residence time distribution in a CSTR.
 - 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 μ mol 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 μ mol of glucose/ml-min. What is the specific activity of the crude enzyme preparation?
- 11. a) Derive the performance equation of a mixed flow reactor used for carrying out an enzymatic reaction following Michaelis-Menten equation.
 - 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 |

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- 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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