Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(FT)/SEM-7/FT-703A/2011-12

2011

ENZYME TECHNOLOGY

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 × 1 = 10

i) Enzymes produced by micro-organisms are

a) intracellular b) extracellular

c) both (a) and (b) d) none of these.

ii) In an enzyme catalyzed reaction enzyme molecule

a) increases the activation energy

b) decreases the activation energy

c) increases the free energy of the reaction

d) decreases the free energy.

iii) For the higher value of K_m

a) higher will be the substrate affinity of enzyme

b) lower will be the substrate affinity of enzyme

c) substrate affinity of enzyme will not be affected

d) sometimes substrate affinity is increased and sometimes decreased.

iv) K_m will be equal to substrate concentration when

a) v equals to V_m b) v equals to $\frac{V_m}{2}$

c) v equals to $\frac{V_m}{3}$ d) v equals to $\frac{V_m}{4}$.

v) In competitive inhibition the value of K_m

a) increases

b) decreases

c) does not change

d) first increases then decreases.

vi) In competitive inhibition the value of V_m

a) increases

b) decreases

c) does not change

d) first increases then decreases.

vii) For the purification of extracellular enzyme the step should be omitted is

a) fermentation b) cell disruption

c) protein precipitation d) enzyme purification.

viii) In non-competitive inhibition the value of V_m

a) increases

b) decreases

c) does not change

d) first increases then decreases.

ix) Briggs-Halden relationship is proposed to represent

a) competitive inhibition

b) non-competitive inhibition

c) quasi-steady state concept

d) purification of enzyme.

x) When $K_m = S$

a) $V = V_{max}$ b) $V = V_{max}/2$

c) $V = 2\ V_{max}$ d) $V = V_{max}/3$.

xi) In salt precipitation method the salt commonly used is

a) $(NH_4)_2\ SO_4$ b) NaCl

c) NH_4Cl d) all of these.

xii) In a rotary vacuum filter the amount of filtrate increases when

a) cake resistance decreases

b) cake resistance increases

c) cake resistance decreases and also when it increases

d) not dependent on cake resistance.

xiii) In electrophoresis charged biomolecules are separated on the basis of

a) charge

b) size

c) charge and size

d) neither on the basis of charge nor on the basis of size.

xiv) In aqueous two-phase partitioning - - - are used.

a) polar organic solvent

b) non-polar organic solvent

c) brine solution

d) aqueous polyethylene glycol.

xv) Which of the following processes is based on specific chemical interaction between solute molecules and ligands ?

a) Adsorption chromatography

b) Ion exchange chromatography

c) Affinity chromatography

d) Gas chromatography.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. What are reversible and irreversible inhibitions ? What will be the changes in the nature in the double reciprocal plot on different inhibitions ? 2 + 3

3. a) How ultrafiltration technique can be applied for purification of enzyme ?

   b) What is the role of affinity chromatography in Enzyme purification ? 2 + 3

4. How fractionation and characterization of proteins can be carried out through Analytical Ultracentrifugation Technique ?

5. What should be the criteria of a micro-organism selected for enzyme production ?

6. An enzyme with molecular weight 46,000 at a concentration of 1 mg catalyzed a reaction at a velocity of 0·25 μm/min under optimum conditions. Calculate the following :

   a) Specific activity of the enzyme in terms of unit/mg of protein.

   b) Turnover number. 3 + 2

GROUP – C

(Long Answer Type Questions)

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

7. What are the different techniques of stabilization of soluble enzyme ? What are the advantages of enzyme immobilization ? For chemical modification of enzyme which amino acids are involved for such modification and how ? What are multipart deletion mutation in enzyme ?

3 + 3 + 4 + 5

8. Which of the microbial processes necessitate cell disruption of micro-organism ? Discuss the role of solid shear and its role in cell disintegration. Discuss the role of homogenization in microbial cell disruption. Why scale up of bead mill is limited ? In a homogenizer the homogenizing pressure is 700 bar and the broth density is 1100 kg/m^3 and the specific heat of broth is 4000 J/kg/K. What is the temperature rise ? 3 + 3 + 3 + 6

9. Convert the Michaelis-Menten equation to Lineweaver-Burk formula. How the values of V_m and K_m is determined from this formula ? Using this formula determine the values of V_m and K_m for the following set of data of an enzyme catalyzed reaction :

v **(m-mol / L-min)**	**S (mol / L)**
0.083	0.010
0.143	0.020
0.188	0.030
0.222	0.040
0.250	0.050
0.330	0.100
0.408	0.290

2 + 3 + 10

10. Derive the Ruth equation for constant pressure filtration. The following data were obtained in a constant pressure filtration unit for filtration of a yeast suspension :

t **(min)**	***V*** **(L filtrate)**
4	115
20	365
48	680
76	850
120	1130

Characteristics of the filter are as follows :

$A = 0.28\ m^2$, $C = 1920\ kg/m^3$, $\mu = 2.9 \times 10^{-3}$ kg/m-s,

$\alpha = 4$ m/kg

Determine

i) pressure drop across the filter

ii) filter medium resistance (r_m). 7 + 8

11. Describe the principle of any three enzyme purification method. 3 × 5

12. Why are agitators placed in a reactor ? How is recombinant DNA technology applied for enzyme production ? 5 + 10

13. Discuss the advantages and disadvantages of whole cell immobilization over pure enzyme immobilization. Give five specific examples of industrial application of immobilized enzyme. 5 + 5 + 5