Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech/FT/SEM-7/FT-703A/2012-13

2012
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 :

$10 \times 1 = 10$

i) In a continuous bioreactor $\mu_g = D$ when k_d (cell death rate) is

a) less than zero b) zero

c) greater than zero d) infinite.

ii) In *r* DNA technology which of the following enzymes is/are required ?

a) Endonuclease

b) Ligase

c) Alkaline phosphatase

d) all of these.

iii) Vector used in *r* DNA technology is

a) Plasmid b) Cosmid

c) both of these d) none of these.

iv) Method of immobilization is

a) ionic/chemical bonding

b) entrapment

c) cross linking

d) all of these.

v) In enzymatic cell disruption the enzyme used is

a) Amylase b) Invertase

c) Lysozyme d) all of these.

vi) Which of the following relations between Km and [S] is correct ?

a) $Km \propto [S]$ b) $Km \propto [S]^{-1}$

c) $Km \propto [S]^{2}$ d) $Km \propto [S]^{-2}$

vii) Enzymes are

a) Growth associated product

b) Non-growth associated product

c) Mixed growth associated product

d) None of these.

viii) Micro-organisms follow

a) Zero order

b) First order

c) Second order

d) Third order growth kinetics.

ix) If the doubling time for a micro-organism is 20 min then the value of μ_{net} is

a) $0.7\ hr^{-1}$ b) $1.4\ hr^{-1}$

c) $2.1\ hr^{-1}$ d) $2.8\ hr^{-1}$.

x) Luedeking Piret equation is applied to

a) Enzyme production

b) Acetic acid fermentation

c) Ethanol fermentation

d) Lactic acid fermentation.

xi) In the eqation $1/X\ (dP/dt) = \alpha\mu_g + \beta$, $1/X(dp/dt)$ stands for

a) maximum growth rate

b) yield coefficient for the fermentation

c) specific growth rate

d) specific product formation rate.

xii) Metal ion is usually designated as the enzyme

a) coenzyme b) cofactor

c) apoenzyme d) none of these.

xiii) Which enzyme shows highest turnover number ?

a) Catalase b) Peroxidase

c) Carbonic anhydrase d) Dehydrogenase.

xiv) Heavy metals are

a) Competitive

b) Non-competitive

c) Uncompetitive

d) Irreversible type of inhibitor.

xv) Organic solvent makes protein precipitation by

a) increasing dielectric constant of solution

b) decreasing dielectric constant of solution

c) increasing ionic strength of solution

d) decreasing ionic strength of solution.

GROUP – B

(Short Answer Type Questions)

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

2. What is enzyme immobilization ? What are the methods of immobilization ? 2 + 3

3. What is growth associated, non-growth associated and mixed growth associated product formation model ? Enzyme belongs to which category ? 4 + 1

4. What are the advantages of continuous reactor over batch reactor ?

5. What are the advantages of using microbial source for enzyme production compared to animal and plant source ?

6. Temperature has two-fold effect on enzyme activity Explain.

GROUP – C

(Long Answer Type Questions)

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

7. a) Compare enzyme with inorganic catalyst. What is Q_{10} value ? 3 + 1

b) Derive the final expression of an enzyme fermentation system when oxygen transfer rate (OTR) equals to oxygen uptake rate (OUR). 3

c) A strain of mold was grown in a batch culture on glucose and the following data were obtained :

Time (h)	Cell concentration (g/l)	Glucose concentration (g/l)
0	1.25	100
9	2.45	97
16	5.1	90.4
23	10.5	76.9
30	22	48.1
34	33	20.6
36	37.5	9.38
40	41	0.63

i) Calculate the maximum net specific growth rate

ii) Calculate the apparent growth yield

iii) What maximum cell concentration could one expect if 150g of glucose were used with the same size of inoculum ? 8

8. a) What is substrate inhibition ? Prove that during substrate inhibition at high substrate concentration $v = Vm / [1 + \{ [S] / Ks_1 \}]$ where v, Vm, $[S]$, Ks_1 have their usual meanings. Prove that at low substrate concentration it follows Michaelis-Menten equation.

1 + 5 + 4

b) What will be the expression of substrate concentration (S_{max}) at which the reaction rate is maximum ? 5

9. How enzymatic reactions are dependent on pH and temperature ? How volumetric oxygen transfer coefficient $K_L a$ can be determined by Glucose oxidase method ? What are the drawbacks of this method ? (3 + 3) + 6 + 3

10. Why enzymes are purified ? "Enzymes must be purified before immobilization." Justify. Explain the principle of Chemostat and Turbidostat. 2 + 5 + 4 + 4

11. a) What is Chimeric DNA ? Explain the general method of *r* DNA technology. 2 + 5

b) What is the role of vector in *r* DNA technology ? Give one example each for natural and artificial vectors. Give five examples for application of *r* DNA technology. 2 + 1 + 5

12. How will you commercially produce α-amylase, mentioning strains, media composition, control parameters, and recovery process ? Between surface culture method and submerged fermentation which is favoured for α-amylase production and why ? 10 + 5

13. a) Briefly describe the solid state fermentation process.

    b) Write short note on dynamic method for determination of $K_L a$.

    c) Prove that in a CSTR dilution rate is equal to specific growth rate under steady state condition. What do you mean by productivity ? 5 + 5 + 5