



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 K_m and $[S]$ is correct ?
- a) $K_m \propto [S]$
 - b) $K_m \propto [S]^{-1}$
 - c) $K_m \propto [S]^2$
 - d) $K_m \propto [S]^{-2}$
- 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 equation $1/X (dP/dt) = \alpha\mu_g + \beta$, $1/X(dp/dt)$ 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
- Competitive
 - Non-competitive
 - Uncompetitive
 - Irreversible type of inhibitor.
- xv) Organic solvent makes protein precipitation by
- increasing dielectric constant of solution
 - decreasing dielectric constant of solution
 - increasing ionic strength of solution
 - decreasing ionic strength of solution.

GROUP – B

(Short Answer Type Questions)

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

- What is enzyme immobilization ? What are the methods of immobilization ? 2 + 3
- What is growth associated, non-growth associated and mixed growth associated product formation model ? Enzyme belongs to which category ? 4 + 1
- What are the advantages of continuous reactor over batch reactor ?
- What are the advantages of using microbial source for enzyme production compared to animal and plant source ?
- Temperature has two-fold effect on enzyme activity Explain.

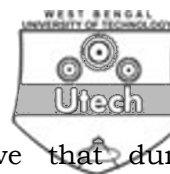
**GROUP – C****(Long Answer Type Questions)**

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

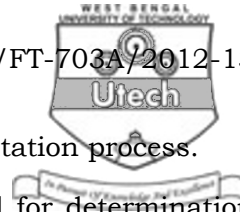
- i) Calculate the maximum net specific growth rate
- ii) Calculate the apparent growth yield
- iii) What maximum cell concentration could one expect if 150g of glucose were used with the same size of inoculum ? 8



8. a) What is substrate inhibition ? Prove that during substrate inhibition at high substrate concentration $v = V_m / [1 + \{ [S] / K_{s1} \}]$ where v , V_m , $[S]$, K_{s1} 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

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