



Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech (FT)/SEM-7/FT-703A/2010-11

2010-11

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 the following : $10 \times 1 = 10$

i) Lipase is the example of

- a) Oxidoreductase b) Transferase
- c) Hydrolase d) Ligase.

ii) In case of non-competitive inhibition, change in

- a) both K_m and V_m lower down
- b) increase both V_m and K_m
- c) increase V_m , but K_m remains constant
- d) increase K_m , but V_m remains constant.



iii) k_{La} depends on

- a) agitation
- b) liquid depth
- c) power number
- d) all of these.

iv) Penicillin is the example of

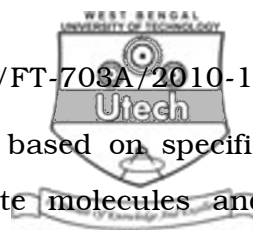
- a) growth associated product
- b) non-growth associated product
- c) mixed growth associated product
- d) none of these.

v) When metal ion is tightly bound with enzyme that is called

- a) metalozyme
- b) metal enzyme
- c) holoenzyme
- d) metazyme.

vi) The binding force in physical adsorption method of enzyme immobilization is

- a) weak
- b) moderate
- c) strong
- d) very strong.



- vii) Which of the following processes is based on specific chemical interactions between solute molecules and ligands ?
- a) Adsorption chromatography
 - b) Ion-exchange chromatography
 - c) Affinity chromatography
 - d) HPLC.
- viii) Electrodialysis is a/an
- a) membrane separation process
 - b) electrolytic separation process
 - c) physical separation process
 - d) none of these.
- ix) Precipitation of proteins can be achieved by adding
- a) PEG-Dextran
 - b) Ammonium sulphate
 - c) Sucrose
 - d) None of these.
- x) Which of the following techniques can be used to remove bacterial cells (0.1 to 10 μm in width) from the process fluid ?
- a) Ultrafiltration
 - b) Reverse osmosis
 - c) Microfiltration
 - d) Dialysis.

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GROUP – B

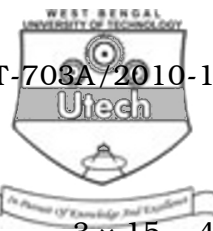
(Short Answer Type Questions)

Answer any *three* of the following.

3 × 5 = 15

2. Write the advantages of enzyme immobilization. Write four applications of immobilized enzymes. 3 + 2
3. Discuss the application of recombinant DNA technique to enzyme technology.
4. What factors would you consider for scaling up a fermenter ? What do you mean by chemostat and terbidostat ? 3 + 2
5. a) “It is easy to purify an extracellular enzyme than an intracellular enzyme.” Justify.

b) Why is immobilized enzyme beneficial than free enzyme ? 2 + 3
6. What are the major steps involved in the separation and purification of intracellular enzymes ?



GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following.

3 × 15 = 45

7. a) The kinetics of inactivation of polyphenol oxidase in mushroom to be first order and the rate constants at 50° C, 55° C and 60° C are 0.019 min⁻¹, 0.054 min⁻¹ and 0.134 min⁻¹ respectively. Calculate activation energy, z value and Q₁₀ value for the inactivation of polyphenol oxidase in mushrooms.
- b) What do you know about enzymatic inhibition ? Describe different types of enzymatic inhibition with schematic diagrams.
- c) The following data were obtained from enzymatic reaction at different substrate concentrations.

S (mg/L).	10	20	30	50	60	80	90	110	130	140	150
V (mg/L-h)	5	7.5	10	12.5	13.7	15	15	12.5	9.5	7.5	5.7

- i) What type of inhibition is this ?
- ii) Determine the constants V_m, K_m and K_{si}.
- iii) Determine the reaction rate at [S] = 70 mg/L.

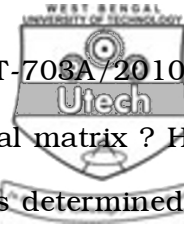
4 + 5 + 6



8. a) Prove that $D = \mu$, under steady state condition in a continuous type bioreactor, where D is dilution rate and μ is the specific growth rate.
- b) Consider the scale-up of a fermentation from a 10 L to 10,000 L vessel. The small fermenter has a height to diameter ratio of 3. The impeller diameter is 30% of the tank diameter. Agitator speed is 500 rpm and three Ruston impellers are used. Determine the dimensions of the large fermenter and agitator speed for
- constant P/V
 - constant impeller tip speed
 - constant Reynolds number.
- c) The air supply to a fermenter was turned off for a short period of time and then restarted. A value for C^* of 7.3 mg/L has been determined for the operating conditions. Use the tabulated measurements of dissolved oxygen (DO) values to estimate the oxygen uptake rate and k_{La} in this system.

	Air off						Air on											
Time (min)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DO (mg/L)	3.3	2.4	1.3	0.3	0.1	0.0	0.0	0.3	1.0	1.6	2.0	2.4	2.7	2.9	3.0	3.1	3.2	3.2

3 + 4 + 8



9. What should be the characteristics of an ideal matrix ? How Volumetric Oxygen Transfer Coefficient k_{La} is determined by sulphite oxidation method. What are the disadvantages of this method ? 5 + 7 + 3
10. Draw a neat sketch of a reactor. What is the function of a sparger and impeller in a reactor ? With diagram show the difference between Bubble column and Loop reactor. 5 + 5 + 5
11. What are the methods of immobilization ? Prove during centrifugation terminal velocity of the particle is $U_o = [gDp^2\rho_p - \rho_f]/18\mu$. 8 + 7
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