Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(CHE-NEW)/SEM-8/CHE-802/2010

2010

BIOTECHNOLOGY AND 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 × 1 = 10

i) The rate of an enzyme-catalyzed reaction is ..... than that of the same reaction when directed by non-biological catalysts.

a) usually not much alter

b) usually much slower

c) usually much faster

d) none of these.

ii) Michaelis-Menten Equation can be equal to the Briggs-Haldane equation when

a) the product releasing step is much slower than the enzyme-substrate complex dissociation step

b) the product releasing step is much faster than the enzyme-substrate complex dissociation step

c) both (a) and (b)

d) none of these.

iii) An enyme containing a non-protein group is known as

a) apoenzyme b) holoenzyme

c) isoenzyme d) none of these.

iv) The molecules which can be separated by ultrafiltration process have the size range

a) 10 - 100 nm b) 2 - 10 nm

c) 0.1 - 10 μm d) 0.1 - 1 nm.

v) Fermentation broths of mold exhibit

a) Newtonian behavior

b) non-Newtonian behavior

c) Ideal behavior

d) none of these.

vi) At steady state dilution rate (D) in chemostat is

a) greater than growth rate

b) less than growth rate

c) equal to growth rate

d) may be both (a) and (b).

vii) When filtration is not a satisfactory separation method for microbial cells or other similar sized particles it may be replaced by the method of

a) Evaporation b) Solvent extraction

c) Centrifugation d) Chromatography.

viii) Allosteric enymes have ..... substrate binding site.

a) only one b) more than one

c) no d) inhibited.

ix) HPLC stands for

a) High performance liquid chromatography

b) High propensity liquid chromatography

c) High purity liquid chromatography

d) High prospect liquid chromatography.

x) Gel chromatography is based on

a) solubility b) density

c) size d) surface activity.

xi) Dextran can be separated from milk whey by

a) Microfiltration b) Ultrafiltration

c) Pervaporation d) Reverse osmosis.

xii) Globular protein contains mainly

a) α–helix b) β–helix

c) γ–helix d) none of these.

GROUP – B

(Short Answer Type Questions)

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

2. Discuss the various methods to determine the Michaelis-Menten constant (k_m).

3. Discuss the nature of primary and secondary structures of protein.

4. State Briggs-Haldane assumptions. What are its limitations ?

5. Enumerate the important types of Chromatographic separations.

6. What do you mean by Micronutrients ? What are their Physiological functions ?

GROUP – C

(Long Answer Type Questions)

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

7. Discuss the essential characteristics of mono and poly saccharides. What is steroid ? How can ethanol be produced using immobilized yeast cells ? 4 + 1 + 10

8. The bioconversion of sucrose by the enzyme sucrase at room temperature resulted in the batch reaction data given in the table below :

Cs	m moles/l	1.0	0.84	0.68	0.53	0.38	0.27
t	hr	0	1	2	3	4	5
	0.16	0.09	0.04	0.018	0.006	0.0025	
	6	7	8	9	10	11	

The initial concentration used was 0.01 m.moles/l. Determine whether these data can reasonably fit the Michaelis-Menten kinetics.

$$-r_A = \frac{k_3 C_3 C_E}{C_s + k_m}$$

where k_m = is the Michaelis-Menten constant. If the fit is reasonable, determine the constants k_3 and k_m . Use integral methods of analysis. 15

9. Prove that for Reverse Osmosis using diffusion type model, the rejection co-efficient,

$R = \dfrac{B\,(\Delta P - \Delta\pi)}{1 + B\,(\Delta P - \Delta\pi)}$ where symbols stand for usual notations.

It is desired to use Ultrafiltration for 800 kg of a solution containing 0.05 wt% of a protein to obtain a solution of 1.10 wt%. The feed is re-circulated by the membrane with a surface area of 0.90 m^2. The permeability of the membrane is 2.50×10^{-2} $kg/s.m^2$. atm. Neglecting the effects of concentration polarization, if any, calculate the final amount of solution and the time to perfrom this using a pressure difference of 0.50 atm. 6 + 9

10. a) What is the difference between chemostat and turbiostat ?

b) Writing a material balance on the cell concentration around chemostat prove that

μ_g (specific growth rate) = D (dilution rate of the reactor).

c) Writing down the material balance on the limiting substrate S in absence of endogenous metabolism, prove that

$X = Y_{x/s}\,(S_o - S)$ at steady state *i.e.*, $ds/dt = 0$ and $\mu g = D$

Where, X = cell concentration, g/L

S_o, S = feed and effluent concentration, g/L

$Y_{x/s}$ = Yield coefficient, gm cell / gm substrate S.

2 + 6 + 7

11. Write short notes on any *three* of the following : 3 × 5

a) Apoenzyme

b) Cofactor

c) Induced fit model

d) Classification of enzymes.