Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–VI EXAMINATION – WINTER 2025

Subject Code:3160512 Date:25-11-2025

Subject Name:Biochemical Engineering

Time:02:30 PM TO 05:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	State the function of following in Eukaryotic cell: 1. Golgi bodies 2. endoplasmic reticulum 3. Chloroplasts	**03**
	(b)	Justify the following statement: 'Agitator is important component for fermenter design'. Write the flow pattern for the following agitator: 1. Disc turbine 2. Pitched blade agitator	**04**
	(c)	Explain the biological process with a suitable block diagram. State the merit and demerit of biological process.	**07**
Q.2	**(a)**	Differentiate between Monosaccharides and Polysaccharides.	**03**
	(b)	Specify building blocks and bond formation for the following: (1) Protein, (2) Disaccharides, (3) Fat, and (4) Nucleotide.	**04**
	(c)	Define the quaternary structure of protein? Classify the following protein based on their structure: 1. Insulin 2. Hemoglobin 3. Glycine 4. Fibrous protein Discuss the three important characteristics of protein.	**07**
		OR	
	(c)	Discuss in brief about property of lipid, its variant and application.	**07**
Q.3	**(a)**	What is enzyme inhibition? List out the various type of enzyme inhabitation.	**03**
	(b)	List out the unit operations involved for separation of products based on the following criteria 1. Size 2. Solubility 3. Diffusivity 4. Vapour pressure	**04**
	(c)	Following sequence describes the reactions of two different substrates catalyzed by one enzyme: $E + S_1 \underset{k_2}{\overset{k_1}{\rightleftharpoons}} ES_1$ $ES_1 + S_2 \underset{k_4}{\overset{k_3}{\rightleftharpoons}} ES_1S_2$ $ES_1S_2 \xrightarrow{k_5} E + P$	**07**

a. Derive the rate equation by making the Michaelis-Menten assumption.
b. What is the rate equation if the concentration of S_1 is much higher than that of S_2 ?

OR

Q.3 **(a)** Sate the important points in designing and constructing a fermenter. **03**

(b) Discuss the following plots for estimation of kinetic parameters: **04**

1. Langmuir plot
2. Line weaver-Burk plot

(c) What is Enzyme immobilization? List out the methods used for enzyme immobilization. Explain the merit of enzyme immobilization over suspended cultures. **07**

Q.4 **(a)** Define the following: **03**

(1) Sterilization (2) Foaming in reactor (3) oxygen uptake rate

(b) State the mechanism and application of following chromatography: **04**

1. Adsorption chromatography
2. Gel-filtration chromatography

(c) The following data were obtained from enzymatic oxidation of phenol by phenol oxidase at different phenol concentrations. **07**

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

a. What type of inhibition is this?
b. Determine the constants Vm and Km.
c. Determine the oxidation rate at [S] = 70 mg/l.

OR

Q.4 **(a)** What is isoelectric focusing? State the mechanism and use of isoelectric focusing in biochemical processing. **03**

(b) Briefly Discuss the following: **04**

(1) cell death kinetics
(2) Monod Equation

(c) Aerobic degradation of an organic compound by a mixed culture of organisms in waste water can be represented by the following reaction. **07**

$C_3H_6O_3 + aO_2 + bNH_3 \rightarrow cC_5H_7NO_2 + dH_2O + eCO_2$

a. Determine a, b, c, d, and e, if $Y_{X/S} = 0.4$ g X/g S.
b. Determine the yield coefficients $Y_{X/O2}$ and $Y_{X/NH3}$.
c. Determine RQ (Respiratory Quotient) for the organisms.

Q.5 **(a)** List the methods available for product recovery. How cell disruption is useful in biochemical processes? **03**

(b) What is volumetric oxygen transfer coefficient? State the factor affecting it. **04**

(c) Discuss the plug flow reactor for biomass processing with a suitable diagram. **07**

OR

Q.5 **(a)** Differentiate between chemostat and turbidostat for biological process. **03**

(b) State the unique features of batch and continuous biomass culture. **04**

(c) Discuss the continuous stirred tank reactor biomass using a suitable diagram. **07**

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