GUJARAT TECHNOLOGICAL UNIVERSITY

BE 6 SEMESTER – OLD PAPER – S22 TO S26 – QUESTION BANK

Subject Name & Code: Biochemical Engineering - 3160512

Chapter 1: Biochemical engineering as an interdisciplinary course, comparison of chemical and biochemical processes, Integrated bioprocess systems, Unit Operations in Bioprocess, microbiology fundamentals, Prokaryotic and Eukaryotic cells and their comparison; important features.

Repeated Questions:

1. Chemical vs Biochemical Processes & Interdisciplinary Nature:

- **Q.** Differentiate between Chemical and Biochemical process with a suitable example. **(SUMMER 2022, 7 Marks; SUMMER 2023, 3 Marks; WINTER 2024, 7 Marks)**

2. Unit Operations & Integrated Bioprocessing:

- **Q.** List out the unit operations involved in biochemical processes. **(SUMMER 2022, 7 Marks; WINTER 2022, 3 Marks; SUMMER 2023, 7 Marks; SUMMER 2024, 3 Marks; WINTER 2024, 7 Marks)**
- **Q.** Write in brief notes on various steps involved in integrated bioprocessing. **(SUMMER 2023, 7 Marks; SUMMER 2024, 7 Marks)**

3. Prokaryotic & Eukaryotic Cells:

- **Q.** State the important differences between prokaryotes and eukaryotes. **(SUMMER 2022, 7 Marks; WINTER 2022, 3 Marks; WINTER 2024, 7 Marks)**

Other Important Questions:

1. Chemical vs Biochemical Processes & Interdisciplinary Nature:

- **Q.** Justify the statement "Biochemical engineering is an interdisciplinary course." **(SUMMER 2023, 4 Marks)**
- **Q.** List out the process in Biochemical engineering, which required knowledge of other engineering field. **(SUMMER 2026, 3 Marks)**
- **Q.** Distinguish between bioprocess engineering and biochemical engineering. **(SUMMER 2025, 3 Marks)**

2. Prokaryotic & Eukaryotic Cells:

- **Q.** For animal and plant cells, mention the following differences: 1. Cell wall 2. Chloroplast 3. Vacuoles 4. Endoplasmic reticulum **(SUMMER 2025, 4 Marks)**
- **Q.** State the function of following in Eukaryotic cell: 1. Golgi bodies 2. endoplasmic reticulum 3. Chloroplasts **(WINTER 2025, 3 Marks)**

3. Unit Operations & Integrated Bioprocessing:

- **Q.** Explain the biological process with a suitable block diagram. State the merit and demerit of biological process. [Diagram required – refer to the original question paper] **(WINTER 2025, 7 Marks)**

4. Fermentation Processes & History of Biochemical Engineering:

- **Q.** Explain the method of manufacturing of industrial alcohols using biotechnology route? **(WINTER 2022, 7 Marks)**
- **Q.** Define aerobic and anaerobic fermentation process with an example of each. **(WINTER 2022, 3 Marks OR)**

- **Q.** Discuss various developments that took place in history for biochemical engineering and its products. **(SUMMER 2024, 4 Marks OR)**
- **Q.** Explain range of fermentation process **(SUMMER 2024, 3 Marks)**

Chapter 2: Chemicals of life: carbohydrates- types and functions, proteins- functions, elemental composition and types of proteins, basic idea about primary, secondary and tertiary structure of proteins, protein denaturation. Lipids- classifications and functions.

Repeated Questions:

1. Proteins:

- **Q.** Explain the types of protein with a suitable example? Discuss the factor affecting protein denaturation. **(SUMMER 2022, 7 Marks; SUMMER 2023, 7 Marks; SUMMER 2024, 7 Marks OR; WINTER 2024, 7 Marks)**
- **Q.** What is the denaturation of protein? List out the five major biological functions of proteins. **(SUMMER 2025, 7 Marks OR; SUMMER 2026, 7 Marks OR)**

2. Carbohydrates:

- **Q.** What is carbohydrate? Explain the types and function of carbohydrates. **(SUMMER 2022, 3 Marks; SUMMER 2023, 3 Marks; SUMMER 2024, 7 Marks)**
- **Q.** Compare between Monosaccharides, Disaccharides and Polysaccharides. **(WINTER 2025, 3 Marks; SUMMER 2026, 4 Marks)**

3. Lipids:

- **Q.** Classify Lipid based on its structure. Discuss the important functions of lipid. **(SUMMER 2023, 7 Marks OR; WINTER 2025, 7 Marks OR; SUMMER 2026, 7 Marks)**

Other Important Questions:

1. Carbohydrates:

- **Q.** Define polysaccharides. Differentiate between amylose and amylopectin in terms of their structure, composition, and function. **(SUMMER 2022, 7 Marks OR)**
- **Q.** Explain Polysaccharides with its examples. **(WINTER 2024, 3 Marks)**

2. Proteins:

- **Q.** Classify protein based on its structure. What is the function of transport protein? **(SUMMER 2025, 4 Marks)**
- **Q.** 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. **(WINTER 2025, 7 Marks)**

3. Biomolecule Building Blocks & Synthesis:

- **Q.** Define and write chemical reactions for the synthesis of: 1. Fat 2. Sucrose 3. Amylose **(SUMMER 2025, 7 Marks)**
- **Q.** Specify building blocks and bond formation for the following: (1) Protein, (2) Disaccharides, (3) Fat, and (4) Nucleotide. **(WINTER 2025, 4 Marks)**

Chapter 3: Properties of enzymatic reactions, Various models for enzyme-substrate complex formation, factors affecting enzyme activity, Michaelis-Menten equation: derivation and graphical evaluation of kinetic parameters, Enzyme inhibition, Enzyme immobilization, different methods of immobilization, Industrial enzymes and their applications.

Repeated Questions:

1. Enzyme Immobilization:

- **Q.** Discuss the merit and demerit of Enzyme immobilization in biochemical process. **(SUMMER 2022, 4 Marks OR; WINTER 2022, 3 Marks; SUMMER 2023, 4 Marks OR; SUMMER 2024, 4 Marks; WINTER 2024, 7 Marks; SUMMER 2025, 3 Marks; WINTER 2025, 7 Marks OR; SUMMER 2026, 4 Marks OR)**

2. Enzyme Inhibition:

- **Q.** List out the factor affecting enzymatic activity. Derive an expression for noncompetitive inhibition with a suitable diagram. [Diagram required – refer to the original question paper] **(WINTER 2022, 7 Marks OR; SUMMER 2023, 7 Marks OR; SUMMER 2025, 4 Marks OR; SUMMER 2026, 3 Marks OR)**
- **Q.** What is enzyme inhibition? List out the various type of enzyme inhibition. Derive an expression for competitive inhibition with a suitable diagram. [Diagram required – refer to the original question paper] **(SUMMER 2022, 7 Marks OR; WINTER 2024, 4 Marks; WINTER 2025, 3 Marks)**

3. Enzyme Properties, Models & Catalytic Features:

- **Q.** Explain the Lock and Key model with diagram for enzymatic reactions. [Diagram required – refer to the original question paper] **(WINTER 2022, 7 Marks; SUMMER 2024, 7 Marks)**

4. Michaelis-Menten Kinetics (Theory):

- **Q.** Outline the method of the graphical evaluation of kinetic parameters derived from the Michaelis-Menten equation? **(WINTER 2022, 4 Marks; WINTER 2025, 4 Marks OR; SUMMER 2026, 7 Marks)**
- **Q.** Derive an expression for enzyme kinetics using the Michaelis-Menten approach. State the assumption made in this approach. **(SUMMER 2022, 7 Marks; WINTER 2024, 7 Marks; SUMMER 2025, 3 Marks OR; SUMMER 2026, 3 Marks OR)**

5. Enzyme Classification & Industrial Enzymes:

- **Q.** How the enzymes are classified? Discuss the importance of Industrial enzymes. **(WINTER 2022, 3 Marks OR; SUMMER 2023, 3 Marks OR; SUMMER 2024, 4 Marks OR; WINTER 2024, 4 Marks OR; SUMMER 2026, 3 Marks)**

6. Factors Affecting Enzyme Activity:

- **Q.** Explain the effect of pH and temperature on enzyme activity. **(SUMMER 2022, 7 Marks; WINTER 2024, 4 Marks; SUMMER 2025, 4 Marks; SUMMER 2026, 4 Marks)**

Other Important Questions:

1. Enzyme Properties, Models & Catalytic Features:

- **Q.** Discuss the limitation of bio-catalyzed reaction. **(SUMMER 2024, 3 Marks OR)**
- **Q.** Explain Allosteric enzymes. **(WINTER 2024, 3 Marks)**
- **Q.** Explain: 1) Proximity effect of enzyme 2) Orientation effect of enzyme 3) specific activity **(WINTER 2024, 3 Marks)**
- **Q.** Explain the reason behind higher selectivity of enzyme catalyzed reaction over conventional chemical reaction. List out factor affecting activity of enzymatic reaction. **(SUMMER 2026, 7 Marks)**

2. Enzyme Kinetics: Numerical Problems:

- **Q.** A substrate is converted to a product by the catalytic action of an enzyme. Assume that the Michaelis-Menten kinetic parameters for this enzyme reaction are: K_M = 0.03 mol/L, r_{max} = 13 mol/L·min. a. What should be the size of a steady-state CSTR to convert 95% of incoming substrate C_{S0} = 10 mol/L with a flow rate of 10 L/hr? b. What should be the size of the reactor if a plug flow reactor is used instead of the CSTR in part (a)? **(SUMMER 2025, 7 Marks)**
- **Q.** The initial reaction rate of hydrolysis of acetylcholine (substrate) by dog serum (source of enzyme) and obtained the following data: [Diagram required – refer to the original question paper] Evaluate the Michaelis-Menten kinetic parameters by employing (a) the Langmuir plot (b) the Lineweaver-Burk plot (c) the Eadie-Hofstee plot. **(SUMMER 2025, 7 Marks OR)**
- **Q.** The following data have been obtained for initial enzyme concentration [E_0] for an enzyme-catalysed reaction. [Diagram required – refer to the original question paper] a. Find K_m. b. Find maximum forward velocity of the reaction V_m for [E_0] = 0.015 g/l. c. Find rate constant k_2. **(WINTER 2024, 4 Marks)**
- **Q.** The following data were obtained from enzymatic oxidation of phenol by phenol oxidase at different phenol concentrations. [Diagram required – refer to the original question paper] a. What type of inhibition is this? b. Determine the constants V_m and K_m. c. Determine the oxidation rate at [S] = 70 mg/l. **(WINTER 2025, 7 Marks)**

3. Enzyme Immobilization:

- **Q.** What is Damköhler number? Give its significance. **(WINTER 2024, 3 Marks)**

4. Michaelis-Menten Kinetics (Theory):

- **Q.** Following sequence describes the reactions of two different substrates catalyzed by one enzyme: [Diagram required – refer to the original question paper] 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? **(WINTER 2025, 7 Marks)**

Chapter 4: Sterilization and media preparation, different types of solid media, cell death kinetics, Air sterilization, steam sterilization, batch and continuous sterilization. Stoichiometry of microbial growth and product formation, elemental balances, degree of reduction, yield coefficient, respiratory quotients. Oxygen uptake rate, Biomass production in cell cultures, phases of microbial growth, measurement of microbial growth by various methods, Monod growth kinetics, Evaluation of kinetic parameters, substrate and product inhibition, maintenance energy, environmental factors affecting microbial growth.

Repeated Questions:

1. Sterilization & Cell Death Kinetics:

- **Q.** List out the techniques used for sterilization. Explain the need of sterilization? **(WINTER 2022, 4 Marks; SUMMER 2023, 3 Marks; WINTER 2024, 7 Marks OR)**
- **Q.** Discuss the following (1) cell death kinetics (2) Microbial growth phases **(SUMMER 2022, 7 Marks; WINTER 2025, 4 Marks OR; SUMMER 2026, 4 Marks)**
- **Q.** Discuss the air sterilization process for a large scale aerobic fermentor with a schematic diagram. Name a few materials used as air filters. [Diagram required – refer to the original question paper] **(WINTER 2022, 7 Marks; SUMMER 2024, 7 Marks OR)**

2. Media & Nutrients:

- **Q.** Discuss briefly various constituents of a liquid media used for growth of yeast and give examples. **(WINTER 2022, 4 Marks OR; SUMMER 2024, 4 Marks; SUMMER 2024, 3 Marks)**

3. Microbial Growth, Measurement & Kinetics:

- **Q.** Write down Monod equation of microbial growth and explain the terms therein. **(SUMMER 2022, 4 Marks OR; WINTER 2022, 3 Marks OR; SUMMER 2023, 4 Marks; WINTER 2024, 3 Marks OR; WINTER 2025, 4 Marks OR)**
- **Q.** Outline the different methods used for measurement of microbial growth? **(WINTER 2022, 4 Marks OR; SUMMER 2024, 3 Marks)**

4. Definitions:

- **Q.** Define the following: (1) Sterilization (2) Yield coefficient, (3) oxygen uptake rate (4) Substrate **(SUMMER 2022, 4 Marks; SUMMER 2023, 4 Marks; SUMMER 2025, 3 Marks; SUMMER 2026, 3 Marks)**

Other Important Questions:

1. Sterilization & Cell Death Kinetics:

- **Q.** Explain the phenomenon of thermal-death kinetics of cells and spores **(WINTER 2022, 7 Marks)**

2. Media & Nutrients:

- **Q.** State the role of chelator, buffer and antifoam in the microbiological process. **(SUMMER 2025, 3 Marks)**
- **Q.** What are major sources of carbon, nitrogen, and phosphorus in industrial fermentations? **(SUMMER 2026, 3 Marks)**

3. Stoichiometry & Yield (Numerical Problems):

- **Q.** Aerobic degradation of benzoic acid by a mixed culture of microorganisms can be represented by $C_6H_5COOH + aO_2 + bNH_3 \rightarrow cC_5H_7NO_2 + dH_2O + eCO_2$ (substrate) a. Determine a, b, c, d, and e if respiratory quotient RQ = 0.9 b. Determine the yield coefficients, $Y_{X/S}$ and $Y_{X/O}$ **(SUMMER 2025, 7 Marks)**

- **Q.** Aerobic degradation of an organic compound by a mixed culture of organisms in waste water can be represented by the following reaction. $C_3H_6O_3 + aO_2 + bNH_3 \rightarrow cC_5H_7NO_2 + dH_2O + eCO_2$ a. Determine a, b, c, d, and e, if $Y_{X/S}$ = 0.4 gX/gS b. Determine the yield coefficients $Y_{X/CO}$ and $Y_{X/NH3}$ c. Determine RQ (Respiratory Quotient) for the organisms. **(WINTER 2025, 7 Marks OR)**

4. Microbial Growth, Measurement & Kinetics:

- **Q.** Describe environmental factors affecting microbial growth of microorganisms. **(WINTER 2024, 3 Marks OR)**
- **Q.** Define the product and substrate inhibition with a suitable example? **(SUMMER 2026, 3 Marks)**

Chapter 5: Growth of organisms in batch reactor, continuous culture of organism, comparison between batch and continuous biomass culture, Stirred tank reactor in series and stirred tank reactor with recycle of biomass. Fed batch reactor, plug flow reactor.

Repeated Questions:

1. Batch Culture & Reactor Configurations:

- **Q.** Compare between batch and continuous biomass culture with suitable example. **(SUMMER 2022, 7 Marks; WINTER 2022, 7 Marks; SUMMER 2023, 7 Marks; WINTER 2025, 4 Marks OR; SUMMER 2026, 4 Marks)**
- **Q.** List out the various configurations for fermentation process. Draw the Fed batch reactor showing important components. [Diagram required – refer to the original question paper] **(SUMMER 2022, 7 Marks; WINTER 2022, 3 Marks; SUMMER 2023, 4 Marks OR; SUMMER 2024, 7 Marks; SUMMER 2025, 4 Marks OR)**
- **Q.** Explain growth of a typical microbial culture in a batch conditions. **(WINTER 2022, 7 Marks OR; SUMMER 2024, 7 Marks; WINTER 2024, 4 Marks OR)**

2. Multi-Stage Reactors & Plug Flow Reactor:

- **Q.** State the important characteristics of Stirred tank reactor in series and stirred tank reactor with recycle of biomass. **(SUMMER 2022, 7 Marks OR; SUMMER 2023, 7 Marks)**

3. Continuous Culture (Chemostat, CSTR & Dilution Rate):

- **Q.** Define the following in context to continuous reactor: (1) critical dilution rate, (2) wash out and, (3) Residence time. **(SUMMER 2022, 4 Marks OR; WINTER 2022, 3 Marks; SUMMER 2023, 3 Marks OR)**

Other Important Questions:

1. Continuous Culture (Chemostat, CSTR & Dilution Rate):

- **Q.** Sketch a single stirred tank reactor and write a cell and substrate mass balance. Derive an expression for dilution rate. [Diagram required – refer to the original question paper] **(SUMMER 2025, 7 Marks)**
- **Q.** Discuss 'Chemostat continuous culture' with dilution rate. **(WINTER 2024, 3 Marks OR)**
- **Q.** Explain with a neat diagram the characteristics equation of continuous culture. [Diagram required – refer to the original question paper] **(SUMMER 2026, 7 Marks)**
- **Q.** Differentiate between chemostat and turbidostat for biological process. **(WINTER 2025, 3 Marks OR)**
- **Q.** Discuss the continuous stirred tank reactor biomass using a suitable diagram. [Diagram required – refer to the original question paper] **(WINTER 2025, 7 Marks OR)**

2. Multi-Stage Reactors & Plug Flow Reactor:

- **Q.** Discuss the plug flow reactor for biomass processing with a suitable diagram. [Diagram required – refer to the original question paper] **(WINTER 2025, 7 Marks)**

Chapter 6: Design of Fermentor, Basic Functions, Body construction, Maintenance of aseptic conditions, Control of parameters, Valves and steam traps, Variants of fermentation vessels, Oxygen requirement in fermentations, Aeration and Agitation, Determination of KLa values, Fluid rheology, Factors affecting KLa values.

Repeated Questions:

1. Agitation, Aeration & K_La:

- **Q.** Discuss the role of impellers used for agitation in fermentor in brief. **(SUMMER 2022, 7 Marks; SUMMER 2023, 4 Marks; SUMMER 2024, 4 Marks; WINTER 2024, 4 Marks OR; WINTER 2025, 4 Marks; SUMMER 2026, 3 Marks OR)**
- **Q.** Discuss the briefly factor affecting K_La value in design of fermentor. **(SUMMER 2022, 7 Marks OR; WINTER 2022, 7 Marks; SUMMER 2023, 3 Marks OR; SUMMER 2024, 4 Marks; WINTER 2024, 7 Marks OR; WINTER 2025, 4 Marks; SUMMER 2026, 7 Marks)**

2. Aseptic Conditions, Control & Contamination:

- **Q.** Explain the role of maintaining the aseptic conditions and control of parameters in fermentation process. **(SUMMER 2022, 7 Marks OR; SUMMER 2023, 7 Marks OR; SUMMER 2024, 4 Marks OR)**

3. Fermentor Design, Components & Valves:

- **Q.** List various types of valves used in biochemical process industry. **(SUMMER 2022, 4 Marks; SUMMER 2024, 3 Marks OR; SUMMER 2025, 4 Marks; SUMMER 2026, 3 Marks OR)**
- **Q.** Draw a schematic of a fermentation vessel. Label the major components and briefly explain their functions. [Diagram required – refer to the original question paper] **(SUMMER 2024, 7 Marks OR; WINTER 2024, 7 Marks)**

Other Important Questions:

1. Fermentor Design, Components & Valves:

- **Q.** For the fermentation, write the importance of (1) Nutrient, (2) Agitator, (3) Aeration, and (4) Steam. **(SUMMER 2023, 4 Marks)**
- **Q.** You as a chemical engineer will decide on which general requirements of Fermentation process. **(WINTER 2022, 4 Marks)**
- **Q.** Outline the various challenges faced during the scale-up process at different level. **(WINTER 2022, 4 Marks OR)**
- **Q.** Discuss the different types of fermenter used in batch and continuous process. **(WINTER 2022, 7 Marks OR)**
- **Q.** List out the product of industrial importance involved the use of fermenter. How the fermenter is operated under controlled conditions in industry? **(SUMMER 2026, 4 Marks)**
- **Q.** List out the utilities of fermenter plant. Explain the importance of media preparation in fermenter? **(SUMMER 2026, 7 Marks OR)**
- **Q.** State the important points in designing and constructing a fermenter. **(WINTER 2025, 3 Marks OR)**

2. Agitation, Aeration & K_La:

- **Q.** Explain why oxygen needs to be supplied at a sufficient rate during aerobic fermentation. **(SUMMER 2024, 3 Marks)**
- **Q.** Discuss various problems that may arise if DO level falls down in an aerobic process **(WINTER 2022, 4 Marks)**

- **Q.** How mass transfer limitations in bioreactors are prevented? List out the variant of it. **(SUMMER 2025, 3 Marks OR)**
- **Q.** Discuss sodium sulfite method for oxygen absorption rate. A fermenter was filled with 10 L of 0.5 M sodium sulfite containing 0.003 M Cu^{2+} ion and the air sparger was turned on. After 10 minutes, the airflow stopped and a 10 mL sample was taken and titrated. The concentration of the sodium sulfite in the sample was found to be 0.21 mol/L. The experiment was carried out at 25°C and 1 atm. Calculate the oxygen uptake and K_La. **(SUMMER 2025, 7 Marks OR)**

3. Aseptic Conditions, Control & Contamination:

- **Q.** Explain the importance of pH in fermentation or enzymatic process for product formation. **(SUMMER 2024, 3 Marks OR)**
- **Q.** What is foaming in a bioreactor? What are the adverse impacts of it? How it can be prevented? **(SUMMER 2025, 3 Marks)**
- **Q.** List out the source of probable contamination generation in a bioreactor. How can it be prevented? **(SUMMER 2025, 4 Marks)**

Chapter 7: Product recovery operations, applications of filtration, cell disruption, centrifugation, liquid-liquid extraction, micro and ultrafiltration, chromatography, electrophoresis, isoelectric focusing in downstream processing.

Repeated Questions:

1. Centrifugation, Filtration, Extraction & Crystallization:

- **Q.** Explain the importance of centrifugation operation role in product recovery. **(SUMMER 2023, 3 Marks; SUMMER 2026, 4 Marks OR)**
- **Q.** Differentiate between microfiltration and ultra filtration method. **(SUMMER 2022, 7 Marks; WINTER 2022, 4 Marks; SUMMER 2023, 4 Marks; SUMMER 2025, 4 Marks OR)**

2. Cell Disruption:

- **Q.** Explain the variant of cell disruption method with merit and demerit of each. **(SUMMER 2022, 3 Marks OR; SUMMER 2023, 7 Marks OR; SUMMER 2024, 3 Marks; WINTER 2024, 3 Marks; WINTER 2025, 3 Marks; SUMMER 2026, 7 Marks OR)**

3. Chromatography, Electrophoresis & Isoelectric Focusing:

- **Q.** List the types of chromatography methods. Explain its role in product recovery. **(SUMMER 2022, 3 Marks; WINTER 2024, 7 Marks OR; SUMMER 2025, 7 Marks OR; WINTER 2025, 4 Marks)**
- **Q.** Discuss the electrophoresis process in biochemical processing. **(SUMMER 2022, 3 Marks OR; SUMMER 2026, 4 Marks OR)**

Other Important Questions:

1. Product Recovery Overview & Separation Methods:

- **Q.** List the product recovery method? Discuss in brief single stage and multistage extraction for biochemical process. **(SUMMER 2023, 4 Marks OR)**
- **Q.** Describe various methods of product separation and purification operations in bioprocess industries in brief. **(WINTER 2022, 7 Marks OR)**
- **Q.** List out procedures involved in the separation and purification of intracellular enzymes. Tabulate the unit operations and their range for recovery and purification of products based on: 1. Size 2. Diffusivity 3. Surface activity 4. Density. [Diagram required – refer to the original question paper] **(SUMMER 2025, 7 Marks)**
- **Q.** List out the methods used for the separation of soluble products. **(SUMMER 2025, 3 Marks OR)**
- **Q.** List out the unit operations involved for separation of products based on the following criteria 1. Size 2. Solubility 3. Diffusivity 4. Vapour pressure **(WINTER 2025, 4 Marks)**

2. Centrifugation, Filtration, Extraction & Crystallization:

- **Q.** Define crystallization and state its application in biochemical industry. **(SUMMER 2024, 4 Marks)**

3. Chromatography, Electrophoresis & Isoelectric Focusing:

- **Q.** What is isoelectric focusing? State the mechanism and use of isoelectric focusing in biochemical processing. **(WINTER 2025, 3 Marks OR)**

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