

# BIOCHEMICAL ENGINEERING

FULL

MARKS: 100

1. Introduction: Interaction of biochemistry, microbiology, chemical engineering with biochemical engineering

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2. Mass Transfer: Introduction to transport phenomenon, different types of mass transfer in processes. Mass transfer phenomena in microbial systems, mass transfer in foods, diffusion, membrane transport, dialysis, nutrient uptake rate of microorganisms, dissolved oxygen concentration, measurements, and volumetric oxygen transfer coefficient measurements inside a fermenter.

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3. Kinetics: Enzyme kinetics, microbial growth kinetics including basic growth equation from various aspects i.e. from cell no increase & from incremental increase in the population over a small growth time. Microbial growth kinetics.

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4. Aeration and agitation in fermenter: Formation of separate gas bubbles, ascending velocity of gas bubbles, mechanical agitation of a gassed Newtonian fluid, decrease in power requirement during agitation, oxygen requirement, measurement of absorption coefficient bubble aeration with mechanical agitation, correlation between volumetric oxygen transfer coefficient (K<sub>LA</sub>) and operating variables in the fermenter.

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5. Sterilization: Different methods of sterilization for Destruction of microorganisms, air filtration through fibrous bed, significances of different types of filter beds, mechanism of collection of microorganisms and characteristics of collection efficiency, limitations of different types of filter beds.

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6. Media sterilization: Dry heat sterilization, sterilizer, design, criteria, Bigelow's Bio theory, batch sterilization process, continuous sterilization process, basic relation responsible for the loss of nutrient value in the food

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7. Fermenter design: Basis of design, design of its component parts, design of different parts of fermenter, conception of several types of biochemical reactors. 10

8. Instrumentation of process control during fermentation: Control of various physical & chemical process, parameters, uses of suitable sensor control operation, computer control.

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9. Continuous fermentation

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10. Enzyme engineering: Enzyme production processes enzyme isolation techniques, different methods of enzyme purification, immobilized enzyme technology, methods of immobilization, separation of one optical variety from its racemic modification by the use of immobilized enzyme, different uses of immobilized enzymes in industry. 10

11. Basic principle and applications of genetic engineering:

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12. Scale up in fermentation: Scale up on the basis of power unit volume of liquid, scale up on equal mixing time basis, scale up on equal share basis.

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13. Product of purification

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14. Waste - water engineering: Fundamental of biological waste treatment , concept of biological oxygen demand or biochemical oxygen demand (COD) & their correlations , treatment techniques in discharged industrial wastes, conception about effluent treatment plants & its utility, waste treatment of effluent coming from food industry.

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Practicals

1. Introduction, layout of fermentation technology pilot plant.
2. Follow -up of bacterial growth in batch cultures.
3. Heat inactivation of enzymes, calculation of rate constant, thermal death rate etc
4. Thermal death time of bacteria
5. Mass transfer across membrane, permeability, coefficient, uptake of solute in biological systems.
6. KLA measurement by dynamic method, effect of air flow rate and rpm.
7. Biochemical oxygen demand measurement.
8. Chemical oxygen demand measurement
9. 200 liter fermenter operation, instrumentation etc.

#### TEXT BOOK

1. Stanbury , Principle of Fermentation Technology.
2. Henry C, Vogel Noyes, Fermentation and Biochemical engineering hand book, Publication
3. James E. Bailey, David F. olitis .Biochemical Engineering Fundamental .MCgraw Hill Book Company
4. Christie J. Geanleplis, Transfer process & unit operation 3<sup>rd</sup> Edition, Prentics hall of India Ltd. New Delhi
5. I bea & Humprey Biochemical Engineering Fundamentals
6. D. Patranibs, Principles of Industrial Instrumentation Tata Mcgraw publishing company Ltd, New Delhi