

Syllabus of PhD written Test EVEN Semester 2025-26

Microbiological Engineering

Microbial growth, Aerobic and anaerobic growth phenomena, Synchronous culture, Mathematical modeling of microbial growth, Product kinetics, Batch, Fed-batch and continuous culture cultivation techniques, Growth and non-growth associated product formation, Principles and mechanism of media sterilization – Principles and design, Characteristics of biological fluids.

Fundamentals of Microbiology and Biochemistry

Isolation, Identification and preservation of industrial microorganism, physiology and morphology of bacteria, yeast and fungi, Characteristics of viruses, Bioenergetics of metabolic pathways, Elementary mass balance, Energy balance, ATP generation and Y_{ATP} , Energy yielding and consuming metabolic pathway, Detoxification of Xenobiotic compound, Steroid transformation.

Bioprocess Technology

Industrial importance of microorganism and their application. Selection and genetic improvements of industrial microorganism, Microbial Production of amino acids- Lysine, Glutamic acid; Microbial production of antifungal antibiotics and broad spectrum antibiotics microbial transformation of steroids; microbiological assay techniques and microbiological estimation of antibiotics and vitamins; large-scale fermentation and development of recombinant microorganism.

Environment Biotechnology

Components of environment: Environmental pollutions, its measurements and management; Air control and its control through biotechnology; Water pollution and its control; Microbiology of waste water treatment – Aerobic and anaerobic processes, Treatment scheme for domestic and industrial waste water; Microbial degradation of Xenobiotic compounds; Solid wastes and management; Bioremediation of contaminated soils and waste land; Global environment problems- Ozone depletion

Bioprocess Instrumentation & Control

Biochemical process variables and their measurements; Control principles and their application in bioreactors; Theory of electrode processes and their application; Measurement and control of pH, temperature, dissolved oxygen, aeration and agitation, redox potential, foam, etc. Introduction to biosensors; Transduction principles used in biosensors, Characteristics of biosensors; Microbial biosensors; Fundamentals of digital process control, Use of computer in control and optimization of microbiological processes.

Enzyme Engineering and Technology

Sources and structure of enzyme; Biosynthesis, regulation and control of enzymes in microorganisms; Kinetics of enzymatic reaction, Single and multiple substrate systems, Inhibition–substrate, product and inhibitors, Large-scale production and purification of enzyme; enzyme activity; Immobilization of enzymes and whole cells; External and diffusional mass transfer limitation, Effectiveness factor and modulus; Application of enzyme.

Transport Phenomenon in Microbial System

Unified theory of Momentum, energy and mass transfer; Flow and mixing of Newtonian and non-Newtonian fluids; Gas-liquid mass transfer in microbial systems; Oxygen transfer rate; Single and multiple bubble aeration: Design of spargers and aeration equipment; Mass transfer across free surface as well as freely rising or falling bodies; Basic concept of oxygen transfer coefficient ($K_L a$) and its measurement; Correlation of $K_L a$ with other operation variables; Factors affecting the $K_L a$

Bioreactor Design

Thermodynamics and rate concepts of biological systems; Bioreactor configuration –batch, continuous stirred-tank, tubular, fluidized bed and the like; Kinetic expression; the Monod equation and its generalization; bioreactor design and optimum operations – Mixing characteristics; residence time distribution, Concentration distribution, and Temperature distribution; Biological system parameters ; Process involving microbial flocs; Bioreactor containing microbial films; Basic concepts of scale-up of Bioreactors.

Downstream Processing

Characteristics of fermentation broth; Separation of cells and solid particles; Separation of charged particles, Cell disintegration – dynamo and ultrasonication; Protein precipitation; Product recovery and purification, Filtration Ion exchange, Chromatography, membrane separation, Electrophoresis, Affinity Chromatography, Crystallization , drying gel filtration,

Cross filtration, Cascade separation, Dispersive separation, Adsorption separation; Product recovery train.

Food Science and Engineering

agents present in foods; general introduction of food technology and food preservation ; Food preservation by canning and heat removal technique; Cold storage and freezing including cryogenic freezing of food; Preservation of food by dehydration , preservatives, high osmotic pressure, Antibiotics and radiation; Preservation of food by fermentation.

Genetic Engineering

Gene structure and replication; transcription genetic code and translation ; biochemical genetics; Cloning strategies; recombinant selection and characterization; optimization of the expression of cloned genes, cloning vectors and host; DNA sequencing; cloning of insulin gene, Cloning of other genes of industrial interests.