

Department of Higher Education, Government of Odisha
Syllabus for SSB

Subject: Biotechnology

UNIT-I BIOCHEMISTRY.

Chemical composition of biomolecules; Structure, classification and properties of amino acids and fatty acids. Levels of Protein structure (Primary, secondary, tertiary and quaternary), protein folding and protein degradation. Carbohydrate and Lipids (structure, classification and functions), Carbohydrate metabolism, Glycolysis, TCA cycle, β -oxidation of fatty acids, oxidative phosphorylation, Electron transport in Mitochondria and Chloroplast. Classification and nomenclature of enzymes, General principles of enzyme reactions, Enzyme kinetics, Enzyme inhibition.

UNIT-II MOLECULAR BIOLOGY AND GENETIC ENGINEERING.

DNA: structure, types, replication, damage and repair. RNA: structure, types, RNA processing and modification, Regulation of gene expression, Prokaryotic and eukaryotic DNA organization, transcription and translational machineries. Cell signalling molecules and pathways (MAP kinase, JAK-STAT). Chromatin organization and its packaging, Cell cycle events and checkpoints, Apoptosis, Protein sorting and trafficking. Molecular tools and techniques of genetic engineering, different enzymes and vectors used in genetic engineering, gene recombination and gene transfer, Nucleic acid sequencing, genome mapping (physical and genetic mapping), molecular markers for genome analysis.

UNIT-III MICROBIOLOGY AND IMMUNOLOGY.

Methods in microbiology, Isolation and culture of microbes, Microbial growth and factors regulating growth, Metabolic diversity among micro-organisms, Nitrogen metabolism and fixation, Chemotherapeutic agents, Antibiotics and their Mechanism of actions, Microbial diseases and toxins; Innate and acquired Immunity, cells and organs of immune system, Structure and functions of Immunoglobulins, Principle of vaccination and vaccine technology, Major Histocompatibility Complex molecules, Antigen Processing and Presentation, Complement system, Hypersensitivity, immune response to tumor antigens. Infection and AIDS.

UNIT-IV BIOTECHNIQUES AND BIOPROCESS TECHNOLOGY.

Histochemical techniques, UV-Visible and fluorescence Spectroscopy, Centrifugation, Chromatography (Planar, Column, Gas chromatography and HPLC), Electrophoresis (General principles, Native and SDS-PAGE, Agarose gel electrophoresis) Microscopy (SEM, TEM, Fluorescence), Enzyme and cell immobilization techniques in industrial processing, Enzymes in organic synthesis, Proteolytic enzymes, Hydrolytic enzymes. Kinetics of immobilized enzymes, Sources of microbes for industrial use. Fermentation and fermented products, Bioreactors.

UNIT-V ANIMAL, PLANT AND ENVIRONMENTAL BIOTECHNOLOGY

Application of genetic engineering in animals, plants and microbes; production of human hormones, immune modulators and vaccines; various methods of animal cell culture, Hybridoma technology and production of monoclonal antibodies, Stem cell and its applications. Plant tissue culture techniques, Protoplast isolation, culture and fusion; Use of *Agrobacterium tumefaciens* and *A. rhizogenes* in plant biotechnology, Mechanisms of DNA transfer. Microbial degradation of biopolymers: cellulose, xylan, starch, protein. Bioremediation, hazardous waste management. Biotechnological applications for pollution control in paper, pulp and pharmaceutical industries.