

## **M.Phil. (Life Sciences)**

### **Semester-I**

#### **Advance Molecular Biology (MPL-101)**

Prokaryotic and eukaryotic genome organization (structure of chromatic, cot curves, respective DNA, interrupted genes, chromatin remodeling)

DNA replication, enzymes, accessory proteins and mechanism of prokaryotic & eukaryotic DNA replication, Replication of telomeric sequences.

Molecular mechanism of Gene Regulation: Transcription: Organization of transcription unit, mechanism of transcription & its regulation in prokaryotes & eukaryotes (general and specific transcription factor regulatory elements,

Translation, genetic code, prokaryotic & eukaryotic translation, regulation of translation post translational modification of proteins.

Homologous recombination, Holiday function, gene conversion, site specific recombination, operon & regulation, +ve and -ve regulation, lac operon, trp operon & lytic lysogenic cycles in virus.

Transposons (bacteria, drosophila, maize), eukaryotic transposons, retero-transposons, Ribozymes

Regulation of gene expression in eukaryotes, levels & mechanism of gene expression, Protein targeting, DNA methylation.

Cellular signaling and Trafficking: Cell Signaling and signal transduction

Genomics and Proteomics: Gene cloning, sequencing and the tolls for their elucidation.

#### **Immunology and Immunotechnology (MPL-102)**

Historical perspective of Immunological science.

Cellular and molecular components of immune system, Introduction to immune system, adaptive & innate immune response, cell & organs of the immune system.

Cellular and Humoral Immunity

Antigens and Antigen and antibody interactions.

Structure & functions of Immunoglobulins, monoclonal antibodies, B and T cell development and differentiation, activation and receptors, mechanism of cell mediated cytotoxicity, Regulation of immune responses.

Immunoglobulins genes, organization of immunoglobulines, Molecular mechanism of generation of antibody diversity, antibody engineering,

The MHC complex, organization & structure (H-2 and HLA complex and polymorphism), antigen procession and presentation, Tissue transplantation, alloantisera HLA typing.

Immunotolerance & autoimmunity-Disorders of immune system, Hypersensitivity reaction.

Complement system, complement components, their structures and functions, mechanism of compliment activation be classical and alternate pathway, complement function test and immunodeficiency diseases.

Immunotechnology: Immunodiffusion, Immunoelectrophoresis, RIA, ELISA, monoclonal antibody production and Antibody engineering

Vaccines-active and passive immunization

Cancer and immunity

### **Advances in Biochemistry (MPL-103)**

**Interaction in Biology system:** Intra and inter molecular forces, Electrostatic interaction and Hydrogen bonding interaction, Vanderwaals and hydrophobic interaction disulphide bridges Role of water and weak interaction.

**pH and buffers:** Handerson-Hasselbatch equation, Laws of thermodynamic, Gibbs energy equation.

**Carbohydrates:** Classification, structure, properties and function of simple and complex carbohydrates.

**Lipids:** Nomenclature and classification, structure, chemicals properties and function of lipids; major phospholipids, sphingolipids, Waxes, terpenes, steroids and prostaglandins

**Proteins:** Essential and non-essential amino acids conformational properties of polypeptides, Primary and secondary structure-helices, J-sheets), tertiary and quaternary structure, structural features of membrane proteins, secondary and ternary prediction of protein conformation.

**Vitamins:** structure, properties, deficiency symptoms and functions including biochemical reactions.

**Hormones:** structure, properties and functions of animal and plant hormones.

**Metabolism** of carbohydrates, glycoloyosis, Krebs cycle, gluconeogenesis, glycogenesis & glycogenolysis, electron transport & oxidative phosphorylation, disorder of glycogen

metabolism, Amino acid, amino acid degradation, oxidative deamination, biosynthesis of amino acids, Lipids - fatty acids synthesis and oxidation.

Enzymes: General properties, kinetics Michaelis-Mention equation, L-B plot, Enzyme inhibition, mechanism of action, regulation of enzyme activity.

## **Microbial Cell Metabolism and Regulation (MPL-104)**

Microbial Diversity

Prokaryotic and eukaryotic organism

Nutritional types of Organism, Chemolithotrophs, Photoautotrophs, and Heterotrophs.

Physiology and Bioenergetics of active transport of solutes across the bacterial cell wall and membrane vesicle.

Energy yielding processes, Energy conservation and generation of reducing power. Growth kinetics and its regulation.

Bacterial photosynthesis, bacterial respiration and biological oxidation processes.

Physiological and biochemical aspects of inorganic nitrogen and sulphur metabolism, Genetics and regulatory mechanism of nitrogen and nitrate metabolism. The metabolism of one carbon compounds.

Biogenesis of wall and membranes in bacteria.

Carbohydrate metabolism and energy production.

Function and regulation of energy reserves polymerases and alternative energy sources.

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Intermicrobial and extramicrobial relationships.

Types of symbiotic relationships, Physiology of intermicrobial association in nature, regulatory mechanism in symbiotic relationship and its energetics.

## **Ecology and Biodiversity (MPL-105)**

Population Ecology - Characteristics structure and Function.

Biotic Community- Characteristics, Structure and Function, Ecological Succession Ecosystem dynamics and Management, Biogeochemical cycles, Energy flow.

Forest Ecosystem, General characteristics, Indian Forests Their status, distribution and management, Tropical rain forest, Global change in forest Ecosystem, Biological Invasion, Natural Verses Human managed Ecosystems.

Agro-ecosystems of traditional societies, Biotechnology in agriculture (Sustainable agriculture).

Nature and natural Resources, Technologies for sustainable management of natural resources.

Wild-life depletion, Biodiversity: concepts and conservation.

Speciation and Extinction.

Biological effects of radiation, Effects of radiation at cellular level-structural and functional changes, whole body effect, genetic, individual verses population effects.

Soil, Air and Water pollution-Environmental Impact assessment.

Remote sensing.

Bioremediation of environmental contaminants.

Biochemical Toxicology-Toxicity of pesticides and metal elements.

Environmental education and sustainable development.

## **Semester-II**

### **Research methodology and Laboratory Technique theory (MPL-201)**

Research-definition-importance and meaning of research-Characteristics of research-Types of Research-steps in research-Identification, selection and formulation of research problems-Research question-Research design-Formulation of Hypothesis-Review of Literature.

Principles and applications of light, phase-contrast and Fluorescent microscope.

Tissue culture technique as applied to higher plants, Cytological and genetical analysis, Chromosome study through tissue-culture, chromosome techniques.

Isolation and culture of microbes, culture collection and resources, important preservation techniques.

Chromatography techniques-Paper, Thin layer, column gas, Affinity, HPLC.

Electrophoresis: principle and uses.

Spectroscopy: their Principles and uses.

Radiotracer Techniques.

Statistical concepts and uses of the following in biology, Measures, of central tendency (mean, Median and mode), Standard deviation and error, co-efficient of variation, T and Chi square test, Bivariate coefficient of correlation, Analysis of variance (ANOVA), Basics of Computer application and essential of bioinformatics

- **Dissertation/Project work (MPL-202)**
- **Seminar/Viva-Voce (MPL-203)**