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M.Sc. Part-II

Life Science-Paper- IV

(APPLIED MICROBIOLOGY)

- I **Introductory Microbiology**
 - 1 History
 - 2. Development of Microbiology
 - 3 Scope of Microbiology
 - 4 Nature of Microbial world

- II **Structure and Functions of Microbial cell**
 - 1 Bacteria
 - 2 Fungi
 - 3 Viruses

- III **Microbial metabolism and Growth**
 - 1 Principles of nutrition
 - 2 Catabolic activities
 - 3 Biosynthesis of macromolecules
 - 4 Growth

- IV **Genetics and Taxonomy of Bacteria**
 - 1 Bacterial genome
 - 2 Mutations
 - 3 Genetic exchange & recombinations
 - 4 Taxonomy of bacteria

- V **Applied Microbiology**
 - 1 Agriculture Microbiology
 - 2 Food Microbiology
 - 3 Medical Microbiology
 - 4 Industrial Microbiology

M.Sc. Part-II

Life Science-Paper-V

(BIO-STATISTICS & MODERN INSTRUMENTAL TECHNIQUES)

1 Biostatistics

Principles and practice of statistical methods in biological research, sample and populations, Basic Statistics-average, statistic of dispersion, coefficient of variation, Standard error; Confidence limits; Probability distributions (binomial, poisson and normal). Test statistical significance, simple correlation of regression: Analysis of Variance, Application of Computers.

2 SEPARATION TECHNIQUES

Principles and applications of gel-filtration, ion-exchange and affinity chromatography; Thin layer and gas chromatography; High pressure liquid (HPLC) chromatography; Electrophoresis and electrofocussing; Ultracentrifugation (velocity and buoyant density); solvent extraction.

Spectroscopic Methods

Principles of biophysical methods used for analysis, X-ray diffraction, fluorescence, UV, ORD/CD, Visible, IR NMR and ESR spectroscopy; Flame photometric; Atomic absorption and plasma emission spectroscopy.

4 Radiochemical Methods

Principles and applications of tracer techniques in biology; Radiation dosimetry; Radioactive isotopes and half life of isotopes, Effect of radiation on biological system; Autoradiography; Cerenkov radiation; Liquid scintillation spectrometry.

Misc. Techniques

A Principles and application of light, phase contrast, fluorescence scanning, and transmission electron microscopy, Cytophotometry and flow cytometry, fixation and staining.

B Ion selective Electrodes, Enzyme electrodes, polarography, stripping methods.

M.Sc.PART-II

Life Science-PPAPER VI; Elective

(MODERN TRENDS IN BIODIVERSITY, CELL BIOLOGY, ETHNOBOTANY)

- 1 Biodiversity: Characterization, generation, maintenance and loss magnitude and distribution of biodiversity, economic value, conservation strategies, cryopreservation.
- 2 Environment impact assessment: Degraded ecosystems and their regeneration; System approach and modelling, prediction of management and developmental plans along time scales; environmental pollution; cumulative effects of pollution on global environment; green house effect, depletion of ozone layer.
- 3 Cell biology: Structure and functions of cells and intra-cellular organelles, Histochemical and ultrastructural aspects of development differentiation and morphogenesis.
- 4 Biotechnology: Cell and tissue culture; callus culture, somaclonal variation, micropropagation; somatic embryogenesis, haploidy, protoplast fusion and somatic hybridization, gene transfer methods, artificial seeds.
- 5 Ethnobotany: Ethnic groups of India; Medicoethnobotany, ethno-agriculture; role of ethnobotany in conservation and domestication of native plant genetic resources.



M.SC. PART - II

Life Science - PAPER VI : Elective :

(MOLECULAR BIOLOGY, GENETICS, ENDOCRINOLOGY & IMMUNOLOGY)

1. Cell and Molecular Biology .

Cell Structure and function :

Structure and function of plasma membrane nucleus, nucleolus, endoplasmic reticulum mitochondria, Golgi apparatus, lysosomes, peroxisomes, ribosomes, Cytoskeleton, Cell division, Cell cycle, Cell - Cell interaction; Cancer cells, Effects of pollutants, drugs, mutagens on the cell.

Molecular Biology :

Chemistry of Nucleic Acids; DNA replication, Chemistry of the Gene Gene Expression : genetic code; transcription translation and its regulation; regulation of gene expression; DNA footprinting. DNA modification and repair mechanism. Isolation and Sequencing of the gene; in - situ hybridization Recombinant DNA technology, Genetic Engineering and its application, RFLP Analysis, PCR, Chromosome walking; DNA fingerprinting.

Gene transfer (Transgenesis) ; Gene therapy.

2. Genetics

Modification of Mendelian inheritance; incomplete dominance. co-dominance; lethal genes, epistasis; Units of inheritance Linkage and crossing over; extra-chromosomes inheritance.

DNA as the genetic material; Organisation of DNA in the chromosomes; histones; non-histone proteins; heterochromatin, euchromatin, Unique sequences, repetitive sequence, transposons.

Mechanisms of Sex Determination, Sex-linked inheritance; Dosage compensation.

Karyotype, chromosome identification technique; Genetic disorders autosomal and sex chromosomal, Non-disjunction, mutations and mutagenesis, in born errors of metabolism, chromosomal aberrations, chromosomes and disease, chromosomes and cancer.

Chromosomes and evolution.

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3. Endocrinology and Reproductive Physiology.

Endocrinology :

Chemical nature of hormones; Homeostasis and feedback regulation; Mechanism of action of hormones; Membrane bound and intracellular receptors; signal transduction, second messengers;

Neuroendocrine integration in vertebrates; Hypothalamo - Hypo-physical complex; role of pineal, adrenal, thyroid, parathyroid; pancreas, heart, thymus and kidney as endocrine organs. Gastro intestinal hormones; hormonal regulation of metabolism. Techniques of RIA, EIA, RRA.

Reproductive Physiology :

Embryology of the gonads and genital ducts, Factors controlling sex determination, endocrinology of the foetal gonads;

Structure and function of the mammalian ovary; folliculogenesis, ovulation, corpus luteum,

Structure and function of the mammalian testis : Spermato-genesis and its control, Sertoli cell, Leydig cell

Structure and function of the epididymis, vas deferens, seminal vesicles, coagulating glands, prostate gland, Cowper's gland, pre-putial gland.

Structure of the Sperm; biochemistry of semen, capacitation of spermatozoa, Fertilization and Acrosome reaction, in-vitro fertilization and embryo transfer. Artificial insemination.

Implantation, placental hormones and their regulation foeto-placental unit. Parturition, lactation.

Principles and techniques of fertility regulation.

4. Toxicology and immunology :

General principles of Toxicology, Classification of toxic agents, Chemo-bioassays and metabolism, Principles of genotoxicology - mutagenesis, Carcinogenesis, mutagens, carcinogens, teratogens, geratogenesis.

Mode of action of toxicants,

Contd.....

Applied toxicology : forensic science; industrial toxicology, Reproductive toxicology, immunotoxicology, environmental policy, socio-economic and legal aspects. Radiation, types, measurement of radiation, effects of radiation on cells, organs, systems, reproductive syndromes.

Immunology :

General principles of immunology; immune and Haemotopetic systems and cells involved in immune response, Antigens, immunoglobulins, Types of immunity, immune response and regulation.

* Techniques in immunology, Immunologically mediated diseases, AIDS, Autoimmune disorders, Transplantation and immunity. Immuno suppression, Applications in basic and clinical sciences.

* Hybridoma Technology Applications of monoclonal antibodies



M.Sc. PART II

Life Science -PAPER VI -Elective:

(BIO-MOLECULES, BIO MEMBRANE, BIOENERGETICS & ENVIRONMENTAL LIFE SCIENCE)

1. A. Macromolecule ASSociation:

Metalloproteins- Metal coordination, reactivities and functional groups of metalloproteins-heme and non-heme.

B. Enzymes and enzyme action:

- i) Recent advances in mechanisms of enzyme action, enzyme specificity and active sites.
- ii) Protein engineering, Solid phase synthesis of proteins/nucleic acids. Engineered protein-modification by chemical and site-directed mutagenetic methods and its applications.

2. A. Membranes: Structure & Function:

- i) Membrane-membrane, membrane-protein associations. Light and high density lipoproteins and their functions.
- ii) Membrane cytoskeletal interactions-actin, tubulin, assembly of microtubules etc.

B. Transport-proteins:

- i) Oxygen transport- eg. Hemoglobin.
- ii) Charge transport-eg. Cytochrome C, & proteins involved in electron transport chain.
- iii) Membrane-related- transport-(Na/H) and (Ca/2H) exchangers and ATPases (Na/K, Ca-and H'-)

3. A. Bioenergetics:

- i) Irreversible thermodynamics, Concepts and their relevance in

B.

Understanding the bioenergetics of open systems (biological systems) and molecular evolution and life processes.

B. Trace Metals:

- i) Inorganic Ion and Trace Metals
- ii) Electrolytes- Na, K, Cl and Bicarbonates.

4. New trends and applications:

- i) Structure prediction methods and other developments in the theoretical biology and their importance in the elucidation of macromolecular structures and functions.
- ii) Lasers and their applications in biology and medicine.
- iii) Radiation therapy; CAT Scan and other image analysis techniques.
- iv) Applications of in-vivo NMR and spectroscopy and positron tomography in biology and medicine.
- v) Synchrotron radiation in medicine.

5. Environmental Life Science :

- i) Air Pollutants - Particulate Matter, compounds of carbon, Sulphur, Nitrogen and their interaction, methods of their estimations.
- ii) Water Pollution - Chief pollutants in domestic, Agricultural and Industrial Waste Methods of their estimation, Effect of pollutants on plants and Animals.
- iii) Biodegradation Technology and Recovery.

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