

ALAGAPPA UNIVERSITY, KARAIKUDI

SYLLABUS FOR
M.Sc BIOTECHNOLOGY ENTRANCE EXAMINATION

(FOR ADOPTION FROM MAY 2007 ONWARDS)

UNIT I: BIOCHEMISTRY AND INSTRUMENTATION

Structure of atom and molecules, Bonding: strong and weak interactions, Structure and properties of water, Buffering in biological system. Structural diversity of biological membrane and mechanism of membrane transport. Structure and biological importance of carbohydrates, proteins, nucleic acid and lipids. Protein folding. Forces stabilizing structure of protein and nucleic acid. Metabolism of Carbohydrate, Protein, Nucleic acid, Lipids, its regulation and bioenergetics. Enzymes: nomenclature, classification, kinetics, regulation of enzyme activity, coenzymes, Abzymes, Ribozymes, clinical and industrial application of enzymes.

Principle, instrumentation and applications of chromatography: TLC, GC, HPLC, gel filtration, ion exchange and affinity chromatography; Electrophoresis and Electro focusing, Centrifugation: ultra centrifugation –velocity & buoyant density. Microscopy: fixation, staining; Principle and applications of light, phase contrast, fluorescence, scanning and transmission microscopy. Radioactive isotopes: Half- life period, biological effects of the radiation, measurement of radioactivity and application of tracer technique in biology. Working principle and instrumentation of colorimetry and spectrophotometry.

UNIT II: MICROBIOLOGY AND IMMUNOLOGY

Microbes in natural habitat - Air, Water & Soil. Classification of Bacteria according to Bergey's manual. Structure and anatomy of bacteria. Viruses: classification and properties, RNA & DNA Virus, Virions & Prions. Microbial physiology, growth factors – Nutritional requirements, Nutritional types. Microbial Pathogenicity: Toxins, Characterization, Mode of action, Drug resistance, Sensitivity tests. Microbial pathogens –*Streptococcus*, *Salmonella*, *Mycobacterium*, *Rhabdovirus*, *Retrovirus*, *Candida*, and

Dermatophytes. Microbial fermentation: Antibiotics, organic acid and vitamins. Microbes in decomposition and recycling process. Microbes and plant interaction: symbiotic and asymbiotic N₂ fixation.

Lymphoid tissues and cells: Ontogeny, development and differentiation of lymphocytes. Immunoglobulins: classification, structure, function and diversity. Types of immunity: Innate and Acquired; Humoral and cell mediated immunity. Immunization: Active and passive. Genetic control of immune response: MHC restriction, Clonal selection theory. Immunological tolerance: Autoimmune disorders, Hypersensitivity reaction. Transplantation immunology. Edible vaccines. Antigen-Antibody reaction: Immuno diffusion, Immuno electrophoresis, Agglutination reaction, ELISA & Western blotting.

UNIT III: CELL BIOLOGY AND PHYSIOLOGY:

Structure of prokaryotic and eukaryotic cell, intracellular compartments; protein sorting, secretory and endocytic pathways; mechanism of cell division (mitosis and meiosis) and cell differentiation; cell-cell interaction; Malignant growth; Immune response: Dosage compensation and mechanism of sex determination, Ageing of cells and stem cell studies.

Physio-chemical processes in animals and plants: Diffusion, Osmoregulation and excretion. Water potential, Turgor and diffusion pressure, plasmolysis, Gibbs-Donan relationship. Circulation and gas exchange. Respiration and photosynthesis: RQ and QIO in relation to metabolism, photosynthesis, oxygen and carbon dioxide exchange. Nutrition: Photo-autotrophism, Heterotrophism. Plant and animal hormones. Reproduction in plants, animals & microbes. Stress physiology.

UNIT IV: MOLECULAR GENETICS AND rDNA TECHNOLOGY:

Principles of Mendelian inheritance, Linkage, crossing-over, sex chromosomes, sex linked and its related inherited disorder. Molecular basis of inheritance. Extra chromosomal inheritance (episome, mitochondria and chloroplast).

Fine structure of gene, Eukaryotic genome organisation (structure of chromatin, coding and non-coding sequences, satellite DNA), structural polymorphism of DNA and RNA, Helix-coil transition. DNA replication, amplification and rearrangements. Transcription in Prokaryotes and Eukaryotes, post transcriptional modifications and its regulation. Genetic code and its properties, Protein synthesis, Regulation of gene expression: attenuation and antitermination. Mutation and mutagenesis; DNA damage and repair mechanisms. Parasexual reproduction process in bacteria: Transformation, Transduction and Conjugation; alpha complementation. Plasmid biology; Biology of bacteriophage λ and M13. Operon concept: lac, trp; Transposons.

DNA modifying enzymes: Restriction enzymes, DNA Polymerase, Reverse Transcriptase, Topoisomerases, Gyases, DNA dependent RNA polymerase, DNA ligases, Nucleases and methylases; DNA cloning: Cloning vectors and expression vectors (Prokaryotes and Eukaryotes). Sequencing of nucleic acids and proteins. Preparation of radiolabelled and non-radiolabelled DNA & RNA probes. Blotting techniques. Construction of genomic DNA library. Principle and applications of PCR. Transgenic plants and animals and its application.

UNIT V: ECOLOGY AND EVOLUTION

Components and types of ecosystem, Ecological niche; Energy flow, food chain, food web; Ecological pyramids, Productivity of different ecosystem. Biogeochemical cycles: Carbon, Phosphorus and Nitrogen. Population ecology and biological control: Density, Growth, Dispersion and Selection. Biotic interactions: positive and negative interactions. Speciation and extinctions, conservation strategies; Biological rhythms, Orientations, Mimicry, migration pattern of birds and fishes, physiological adaptation at higher altitudes. Environmental pollutions and degradations, bioremediation.

Origin of life (including aspects of prebiotic environment and molecular evolution); Concepts of evolution, Theories of organic evolution, Mechanism of speciation, Hardy Weinberg law, genetic polymorphism and selection, origin and evolution of economically important microbes, plants and animals. Introduction to population genetics.