

ALAGAPPA UNIVERSITY, KARAIKUDI
SYLLABUS FOR POST M.Sc., ADVANCED DIPLOMA COURSE IN
MOLECULAR DIAGNOSTICS ENTRANCE EXAMINATION
(FOR ADOPTION FROM MAY 2008 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

Infection – mode of transmission in infections, factors predisposing to microbial pathogenicity, types of infectious diseases. Sample collection- method of collection, transport, processing of samples and general approach to clinical specimens. Interpretation of results. Normal microbial flora of the human body. Nosocomial infections. Host - Parasite relationships. Pathogenicity and diagnosis of infection caused by *Streptococcus*, *Coliforms*, *Salmonella*, *Shigella*, *Vibrio*, and *Mycobacterium*.

Diagnosis of fungal infections - Dermatomyces, Candidiasis and Aspergillosis. Diagnosis of DNA and RNA viruses - Pox viruses, Adenoviruses, Rhabdo Viruses, Hepatitis Viruses and Retroviruses. Diagnosis of Protozoan diseases - Amoebiasis, Malaria, Trypanosomiasis, Leishmaniasis. Study of helminthic diseases - *Fasciola hepatica* and *Ascaris lumbricoides*, Filariasis and Schistosomiasis.

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: MOLECULAR BIOLOGY AND FUNDAMENTALS OF MOLECULAR DIAGNOSTICS

Organization of human genome, Human Genome Project, Identifying human disease genes. Cancer genetics - oncogenes, tumour suppressor genes. Genetic disorders - Sickle cell anaemia, Duchenne muscular Dystrophy, Retinoblastoma, Cystic Fibrosis and Sex linked inherited disorders. Neonatal and Prenatal disease diagnostics. Gender identification using amelogenin gene locus. Amplification of Y chromosome specific Short Tandem Repeats (Y-STR). Analysis of mitochondrial DNA from maternal inheritance. Gene therapy and other molecular based therapeutic approaches. Genes in pedigree; Genetic Counselling.

Isolation and Purification of Nucleic acids- Principles and Methods. Nucleic acid amplification methods and types of PCR: Reverse Transcriptase-PCR, Real-Time PCR, Inverse PCR, Multiplex PCR, Nested PCR, Alu-PCR, Hot-start, *In situ* PCR, Long-PCR, PCR-ELISA, Arbitrarily primed PCR, Ligase Chain Reaction. Applications of PCR- PCR based microbial typing: Eubacterial identification based on 16S rRNA sequences-

Amplified Ribosomal DNA Restriction analysis (ARDRA)-Culture independent analysis of bacteria- DGGE and TRFLP. Molecular diagnosis of fungal pathogens based on 18S rRNA sequences- Detection of viral pathogens through PCR. RAPD for animal and plants- PCR in forensic science-AmpFLP, STR, Multiplex PCR- Determination of Paternity- Human identification and sex determination. Molecular cloning, labeling of nucleic acids, hybridization. Construction of Genomic DNA Library- Metagenomic DNA Library using Fosmid vector- Screening of recombinants. Automated DNA sequencing- Principles, Methods and Instrumentation - Advances in DNA sequencing- Pyrosequencing- Microarrays- Personalised Medicine- Pharmacogenomics. Proteomics- Clinical Proteomics.

UNIT IV: 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.