Semester V

PAPER 7 Applied Molecular Genetics and Bioinstrumentation (Subjective)

Unit I

- Polymerase Chain Reaction (PCR)
- DNA fingerprinting, Restriction Fragmentation Length Polymorphism (RFLP)
- Detection of proteins, SDS-PAGE, ELISA, Western blotting, hybridoma technology
- Methods of gene transfer: electroporation, microinjection

Unit II

- Gene therapy, Development of transgenics
- Applications of recombinant DNA technology: crop and live stock improvement, DNA drugs and vaccines
- DNA diagnostics--Genetic analysis of human diseases, detection of known and unknown mutations

Unit III

- Microscopy: Principles and Application--Light microscopy, Dark field microscopy, Phase-contrast microscopy
- Fluorescence microscopy, confocal microscopy, electron microscopy
- Photography-- digital imaging and image processing

Unit IV

- Centrifugation: principle, types of rotors, high speed and ultracentrifuge
- Colorimetry and spectrophotometry: Beer-lambert law, absorption spectrum
- Chromatography: paper, thin layer, column---ion-exchange, gel filtration, HPLC, affinity

PAPER 8 Biostatistics and Bioinformatics (Subjective)

Unit I

- Calculations of mean, median, mode, variance, standard deviation
- Concepts of coefficient of variation, Skewness, Kurtosis
- Elementary idea of probability and application
- Frequency distribution, graphical presentation—bar, pie diagram, histogram
- Tests of significance: t-test and Chi-square test

Unit II

- Basics (CPU, I/O units) and operating systems
- Computer networking, internet and e-mail
- Concept of homepages and websites, World Wide Web, URLs, Search engines

Unit III

- Primary and secondary databases: nucleic acids, genomes, protein sequences and structures, PDB, NCBI, EMBL
- SNP db, Literature databases, PubMed, Gene, Genomes
- Information retrieval from biological databases, Entrez system, SRS

Unit IV

- Sequence analysis: Pairwise and multiple sequence alignments
- BLAST, CLUSTALW
- Protein structure prediction---visualizing 3D-structures of proteins
- Phylogenetic analysis, PHYLIP

Practical Syllabus

1.Biostatistics

- Application to genetic problems based on theory .
- Calculation of mean, median, mode, standard deviation, t-test, chi-square test.

2.Molecular Biology

- Preparation of buffers and solutions.
- Verification of Beer's law and calculation of molar extinction coefficient.
- Identification of amino acids in a mixture using paper chromatography.
- Preparation of standard curve using BSA for protein estimation.
- Estimation of proteins in rat tissues.
- Polyacrylamide Gel Electrophoresis (PAGE) for detection of DNA
- DNA extraction from blood.
- Quantitation of DNA using spectrophotometer.
- Agarose gel electrophoresis for detection of DNA.
- Restriction digestion of Lamda DNA using teaching kit.
- DNA fingerprinting using teaching kit.
- Multiplex Polymerase Chain Reaction (mPCR) using teaching kit.
- Culture work using laminar flow, Bacterial Growth curve.

3.Seminar/Project

4.Class Record

5.*Viva-voce*

Semester VI

PAPER 9 Immunogenetics & Microbial Genetics (MCQ)

Unit-I

- ➤ Immune system: Innate and Adaptive immunity,
- ➤ Clonal selection and Complement system
- ➤ Humoral immunity and Cell mediated immunity
- ➤ Autoimmune diseases, Hypersensitive reactions, Immune system in human health

Unit-II

- ➤ Immunoglobulin and T-cell receptor genes: organization of Ig gene loci
- ➤ Molecular mechanism of antibody diversity.
- ➤ HLA complex: organization, Class I and II HLA molecules
- ➤ Expression of HLA genes

Unit-III

- ➤ Methods of gene transfer in bacteria: conjugation, transformation, transduction
- ➤ Genetic analysis of mutants: Recombination and Genetic mapping
- ➤ Molecular biology of pathogens, Mechanism of drug resistance

Unit-IV

- ➤ Microbial technology: Fermentation technology, Synthesis of microbial and recombinant products
- ➤ Life cycles and advantages of organisms commonly used in genetic studies.
- ➤ Genes and gene products in different model systems: T4 and λ phages, *E. coli, Saccharomyces cerevisae*

PAPER 10 Cancer Genetics & Clinical Genetics (MCQ)

Unit I

- Characteristics of cancer cells, Apoptosis, Histopathology
- Types of cancer and their symptoms.
- Cell transformation and tumorigenesis: Proto-oncogenes, Oncogenes, Tumour suppressor genes, DNA repair genes
- DNA repair mechanisms

Unit II

- Metastasis, Tumour specific markers, DNA markers, Single Nucleotide Polymorphisms (SNPs), Cancer therapy
- Epigenetic modifications and Genomic instability
- Cancer and environment: Physical, Chemical, Biological carcinogens

Unit-III

- Human karyotype, Chromosomal anomalies and diseases
- Pedigree analysis: Modes of inheritance, Autosomal dominant, Autosomal recessive, X-linked, Y-linked
- Inborn errors of metabolism, Triplet repeat disorders
- Monogenic disorders and Multifactorial diseases

Unit-IV

- Genome imprinting syndromes & mitochondrial syndromes
- Predictive medicine, Association studies, Population screening
- Management of genetic disorders
- Prenatal diagnosis and Genetic counseling

PAPER 11 Genomics (MCQ)

Unit-I

Organization of genomes
- Overview of prokaryotic and eukaryotic genomes
- Human genome project: mapping strategies
- Mitochondrial genome, nuclear genome, gene density, CpG islands
- Gene families and superfamilies: gene duplication, pseudogenes, repetitive DNA and transposable elements

Unit-II

Comparative Genomics
- Conservation and diversity of genomes
- Genome size and organization of genes
- C-value, number of genes and complexity of genomes
- Comparative genomics as an aid to gene mapping and study of human disease genes

Unit-III

Functional Genomics
- Concepts of transcriptome and proteome
- Microarray technology, 2D-electrophoresis, protein sequencing
- Prediction, diversity and multiplicity of protein and gene functions

Unit-IV

Pharmacogenomics
- Personalized medicine: Concept of pharmacogenomics and pharmacogenetics
- Genetic polymorphisms in drug metabolizing enzymes, drug targets, effects on drug response
- Gene chips: Applications in disease profiling and Drug target discovery