# SYLLABUS

# for

# Ph.D. Molecular Biology and Genetic Engineering

Unit I

Structure and Properties of Nucleic Acids,Nucleosome assembly, DNA replication in prokaryotes, DNA replication in eukaryotes, DNA Repair Mechanisms, Homologous Recombination, Site-specific recombination

Unit II

Transcription in prokaryotes, Transcription in eukaryotes, Post-Transcriptional Modifications, RNA editing, Regulation of Transcription in Prokaryotes, Regulation of Transcription in Eukaryotes, Protein synthesis in prokaryotes, Protein synthesis in eukaryotes

Unit III

Nucleosome remodeling, DNA methylation and gene regulation, Mechanisms of Gene Silencing: RNA interference- RISC-mediated silencing, mechanisms of RNA interference, Role of heterochromatin in gene silencing, Epigenetic Regulation

Unit IV

DNA manipulative enzymes, Principles of Gene Cloning, Desirable properties of vectors, Prokaryotic and Eukaryotic Expression Systems (Constitutive & Inducible): Plasmid Vectors, Phage Vectors, Cosmids, Phagemids, Artificial chromosomes, Lentiviral Vectors, Adenoviral Vectors, Plant Vectors, Insect Vectors

Unit V

Polymerase Chain Reaction, Quantitative Real Time PCR, Gel Electrophoresis, Blotting Techniques: Southern, Western & Northern, Construction of Genomic and cDNA Libraries, Applications of DNA microarray, DNA Sequencing: sanger's method, shotgun and clone contig approach, next generation sequencing

Unit VI

Methods of gene transfer in Plants and Animals: Chemical, Physical and biological methods, Protein Engineering, Site Directed Mutagenesis, Reporter Gene Assays, DNA-Protein Interactions, Protein-Protein Interactions, Targeted Genome Editing: ZFNs, TALENs, CRISPRs, Gene Targeting: Knock-ins & Knock-outs, miRNA and siRNA induced silencing, Application of

miRNA and siRNA,  Transgenic plants and transgenic animals, Gene therapy, Somatic cell nuclear transfer