II SEMESTER

HARD CORE COURSES
BSH451 MOLECULAR BIOLOGY

Course Outcomes:

After successful completion of the course, students will be able to :

CO 1. Understand the molecular basis oflife.
CO 2. Know the role of various enzymes involved in DNA replications.
CO 3. Comprehend gene transcription and its regulation in prokaryotes and eukaryotes.
CO 4. Understand protein synthesis and post-translational modifications
CO 5. Understand the role of non-coding RNAs and miRNAs.

Unit I (13 hours)

Central dogma of molecular biology and its modification. Structure of nucleic acids; structure of DNA, topology, forms of DNA, repetitive DNA, DNA polymerases, DNA ligases, topoisomerases, gyrases, methylases, nucleases and restriction endonucleases, Ribonucleoproteins, Structure of m-RNA, Three dimensional structure of t- RNA, Heterochromatization, transposition, regulatory sequences and transacting factors, homologous recombination

Unit II (13 hours)

Organization of transcriptional units, Mechanism of DNA transcription in prokaryotes and eukaryotes, RNA processing (capping, polyadenylation, splicing, introns and exons), RNA polymerase, types, promoter initiation and transcription, DNA replication (Eukaryotes and prokaryotes) - Semi conservative, replication in *E.coli* and Eukaryote, control of replication, Replication in phage, plasmid and mitochondria, inhibitors of RNA synthesis and their mechanism of action, polycistronic and monocistronic RNAs, post transcriptional modification

Unit III (13 hours)

Protein synthesis in prokaryotes and eukaryotes, role of ribosomes and different types of RNA in protein synthesis, basic feature of genetic code - Triplet codon, Assignment of codons, degeneracy, variation in codon usage, universality, Amino acid activation, mechanism of initiation, elongation and termination, post translational modifications - Protein folding, role of chaperons. O and N glycosylation, Fatty acylation, attachment of glycosyl anchor, phosphorylation, other modifications, inhibitors of protein synthesis

Unit IV (13 hours)

Molecular basis of signal transduction in bacteria, plant and animals, Regulation of gene expression in bacteria and eukaryotes - fine structure of eukaryotic gene, exons, introns, repetitive DNA, Promoters enhancers, silencers, regulatory sequences, DNA-binding Proteins. Organization of Prokaryotic and eukaryotic genes, gene families, tandemly repeating genes, pseudogenes. **Operon Model**: Lac operon, catabolite repression. Negative and positive control, Trp operon attenuation, antitermination. Non-coding RNAs, microRNAs, Genome editing technologies.