

**PAPER II: MOLECULAR GENETICS**

**UNIT I:**

Gene as the unit of mutation and recombination. Identification of DNA as the genetic material. Mutations: molecular nature; mutagenesis by nitrous acid, hydroxylamine, alkylating agents, intercalators and UV; origin of spontaneous mutations and control. Parasexual process in bacteria; transformation, transduction and conjugal gene transfer – the phenomena, mechanisms and applications. Fine structure genetic analysis with examples.

**UNIT II:**

RECOMBINATION – control; models and mechanisms. Gene as the unit of expression. Gene – cistron relationship in prokaryotes and Eukaryotes. Colinearity of gene and polypeptide. Elucidation of the genetic code. Wobble base pairing. Suppression of nonsense, missense and frameshift mutations. Regulation of gene expression in prokaryotes and Eukaryotes. The operon concept – positive and negative control, attenuation control. Control sequences; promoter, operator, terminator and attenuator. DNA methylation and epigenetic regulation.

**UNIT III:**

DNA DAMAGE AND REPAIR:

DNA damage by UV, alkylating agents, cross linkers. Mechanisms of repair – photoreactivation, excision repair, recombinational repair. The SOS and adaptive responses and their regulation. Heat shock response.

**UNIT IV:**

EXTRACHROMOSOMAL HEREDITY:

Biology of plasmids – discovery, types and structure of F, RTF, col-factors and Ti. Replication and partitioning. Incompatibility and copy number control. Natural and artificial plasmid transfer and their applications. Transposable genetic elements: discovery, early experiments of McClintock in maize. Insertion sequence in prokaryotes. Complex transposons – Tn10, Tn5, Tn9 and Tn3 as examples. Mechanisms, control, consequences and applications of transposition by simple and complex elements. Retro elements.

**UNIT V:**

GENETICS OF EUKARYOTES:

Gene linkage and chromosome mapping, crossing over, three point cross, tetrad analysis. Complementation. Organization of chromosomes, specialized chromosomes. Chromosome abnormalities, quantitative inheritance, population genetics. Developmental genetics using Drosophila as model system. Somatic cell genetics.

## REFERENCE BOOKS:

1. Microbial Genetics by S.R.Maloy, J.E. Cronan and D. Friefelde (1994) Jones and Bartlett Publishers.
2. Molecular Genetics of Bacteria by J.W. Dale (1994) John Wiley and Sons.
3. Concepts of Genetics by W.S.Klug and M.R. Cummm Prentice Hall, 1997.
4. Introduction to Genetic Analysis by Griffiths. Freeman & Co., 1996.
5. Advanced Molecular Biology. R.M. Twyman (1998). Viva Books private Limited.
6. Molecular Biology of the Gene, Watson JD, Hopkins NH, Roberts JW, Steitz JA, Weiner AM (1987) The Benjamin / Cumimings Publishing Company.
7. Genes vi, Levin B (1997) Oxford University press.
8. Molecular Cell Biology, Lodish H, Baltimore D, Berk A, Zipursty SL, Matsudaria P, Darnell J (1995) Scientific American Books.