

Units	Topics
I	<p><b>CYTOLOGY</b></p> <p><b>Chromatin organization:</b> Chromosome structure and packaging of DNA, molecular organization of centromere and telomere; nucleolus and ribosomal RNA genes; euchromatin and heterochromatin; karyotype analysis; banding patterns; karyotype evolution; specialized types of chromosomes; polytene, lampbrush, B-chromosomes and sex chromosomes; molecular basis of chromosome pairing.</p> <p><b>Structural and numerical alterations in chromosomes:</b> Origin, meiosis and breeding behaviour of duplication, deficiency, inversion and translocation heterozygotes; origin, occurrence, production and meiosis of haploids, aneuploids and euploids; origin and production of autopolyploids; chromosome and chromatid segregation; allopolyploids, types, genome constitution and analysis; evolution of major crop plants; induction and characterization of trisomics and monosomics.</p>
II	<p><b>GENETICS</b></p> <p><b>Genetics of prokaryotes and eukaryotic organelles:</b> Mapping the bacteriophage genome; phage phenotypes; genetic recombination in phage; genetic transformation, conjugation and transduction in bacteria; genetics of mitochondria and chloroplasts; cytoplasmic male sterility.</p> <p><b>Gene structure and expression:</b> Genetic fine structure; cis-trans test; fine structure analysis of eukaryotes; introns and their significance; RNA splicing; regulation of gene expression in prokaryotes and eukaryotes.</p>
III	<p><b>Genetic recombination and genetic mapping:</b> Recombination; independent assortment and crossing over; molecular mechanism of recombination; role of RecA and RecBCD enzymes; site-specific recombination; chromosome mapping, linkage groups, genetic markers; construction of molecular maps, correlation of genetic and physical maps; somatic cell genetics - an alternative approach to gene mapping.</p> <p><b>Mutations:</b> Spontaneous and induced mutations; physical and chemical mutagens molecular basis of gene mutations; transposable elements in prokaryotes and eukaryotes: mutations induced by transposons; site-directed mutagenesis: DNA damage and repair mechanisms; inherited human diseases and defects in DNA repair; initiation of cancer at cellular level; protooncogenes and oncogenes.</p>
IV	<p><b>CYTOGENETICS</b></p> <p><b>Cytogenetics of aneuploids and structural heterozygotes:</b> Effect of aneuploidy on phenotype in plants; transmission of monosomics and trisomics and their use in chromosome mapping of diploid and polyploid species;</p>

breeding behaviour and genetics of structural heterozygotes; complex translocation heterozygotes; translocation tester sets; Robertsonia translocations; D-A translocations.

V

**Molecular cytogenetics:** Nuclear DNA content; C-value paradox; cot curve and its significance; restriction techniques; multigene families and their evolution; in situ hybridization - concept and techniques; physical mapping of genes on chromosomes; computer assisted chromosome analysis; chromosome microdissection and microcloning; flow cytometry and confocal microscopy in karyotype analysis.

**Alien gene transfer through chromosome manipulations:** Transfer of whole genome, examples from wheat, Arachis and Brassica; transfer of individual chromosomes and chromosome segments; methods for detecting alien chromatin; production, characterization and utility of alien addition and substitution lines; genetic basis of inbreeding and heterosis; exploitation of hybrid vigour.