1. Cell cycle
2. Architecture of chromosome in prokaryotes and eukaryotes; Chromonemata, chromosome matrix, chromomeres, centromere, secondary, constriction and telomere; artificial chromosome construction and its uses;
3. Special types of chromosomes.
4. Evolutionary significance; Introduction to techniques for karyotyping.
5. Chromosome banding and painting -*In situ* hybridization and various applications.
6. Structural and numerical variations of chromosomes and their implications;
7. Symbols and terminologies for chromosome numbers, euploidy, haploids, diploids and polyploids;
8. Utilization of aneuploids in gene location; Variation in chromosome behaviour, somatic segregation and chimeras, endomitosis and somatic reduction;
9. Evolutionary significance of chromosomal aberrations, balanced lethal and chromosome complexes; Inter-varietal chromosome substitutions.
10. Fertilization barriers in crop plants at pre-and post-fertilization levels.
11. *In-vitro* techniques to overcome the fertilization barriers in crops.
12. Polyploidy. Genetic consequences of polyploidization and role of polyploids in crop breeding; Evolutionary advantages of autopolyploid *vs* allopolyploids.
13. Role of aneuploids in basic and applied aspects of crop breeding, their maintenance and utilization in gene mapping and gene blocks transfer;
14. Alien addition and substitution lines, creation and utilization;
15. Apomixes, evolutionary and genetic problems in crops with apomixes.

Reversion of autopolyploid to diploids;

Genome mapping in polyploids; Interspecific hybridization and allopolyploids; Synthesis of new crops (wheat, Triticale, Brassica, and cotton);

Hybrids between species with same chromosome number,

alien translocations;

Hybrids between species with different chromosome number;

Gene transfer using amphidiploids, bridge species.

Chromosome manipulations in wide hybridization; case studies;

Production and use of haploids, dihaploids and doubled haploids in genetics and breeding.