Semester	**III**
Course *1	**Major-2**
Paper Code	**C2BT230322T/P**
Paper Title	**GENETICS**
No. of Credits *2	**4**
Theory / Practical / Composite	**Composite**
Minimum No. of preparatory hours per week a student has to devote	4
Number of Modules	2
Syllabus	**Module A: (30 Marks; 2 classes/week)** **UNIT I: Modes of Inheritance: Mendelian genetics:** Mendel's laws of segregation & independent assortment, monohybrid, dihybrid and trihybrid crosses, test and back crosses. Allelic interactions: dominant & recessive genes, incomplete dominance, codominance, pleiotropy, multiple alleles, lethal genes, penetrance and expressivity. Non-allelic interactions: interactions producing new phenotype, epistasis, complementary genes, duplicate genes, inhibitory genes. Sex determination and sex linkage: Mechanisms of sex determination, Barr bodies and dosage compensation, sex linked inheritance, sex influenced dominance, sex limited traits. **UNIT II: Chromosome and genomic organization:** Unique & repetitive DNA, satellite DNA, centromeric and telomeric DNA, VNTRs, STRs. Eukaryotic chromosome morphology: euchromatin and heterochromatin, packaging of DNA molecules into chromosomes, chromosome banding patterns, one gene one polypeptide hypothesis, concepts of cistron, exons, introns. **UNIT III: Chromosomes:** Chromosome mutations: Variations in chromosome structure: deletion, duplication, inversion and translocation, position effects of gene expression. Variations in chromosome number: aneuploidy and euploidy. Chromosomal aberrations in human beings. **UNIT IV: Genetic linkage, crossing over and extrachromosomal inheritance:** Linkage and recombination of genes in a chromosome, crossing over, cytological basis of crossing over, crossing over at four strand stage, crossing over and genetic mapping. Extra chromosomal inheritance: cytoplasmic organelle heredity, maternal effects. **Module B: (15 Marks; 1 class/week)** **UNIT V: Gene mutations:** Definition and types of mutations, causes of mutations, Ames test for mutagenic agents. DNA damage and repair: causes and types of DNA damage, mechanisms of DNA repair - Photoreactivation, Base excision repair, Nucleotide excision repair, Mismatch repair, Double strand break repair, Translesion synthesis. **PRACTICAL** **(CIA: 30 marks; Attendance: 2 marks; End Semester: 8 marks)** 1. Study of mitosis from root tip cells of *Allium cepa* L. 2. Study of meiosis from flower buds of *Allium cepa* L. 3. Study of meiosis from grasshopper testis

	4. Study of symmetric and asymmetric karyotypes in plants 5. Identification of chromosomal aberrations in human with the help of photographs 6. Demonstration of Barr Body localization 7. Testing of the goodness of fit of Mendelian Ratios 8. Practical problems on genetics (Inventory of Human traits, blood group genetics, etc.)
Learning Outcomes *[3]	**Learning Outcomes (Theory)** 1. impart a comprehensive understanding of the principles of genetics and the modes of inheritance. 2. provide an overview of the basic structure of chromosomes, chromosome function and chromosome mutations. 3. provide a comprehensive idea about genetic linkage, crossing over and extra chromosomal inheritance. 4. introduce students to DNA damage and mutation. 5. thereafter introduce students to various DNA damage repair pathways and their detailed mechanisms **Learning Outcomes (Practical)** 1. Students will learn the basic techniques of chromosome preparation and analysis from plant and animal samples leading to elucidation of karyotype. 2. Students will also learn basic statistical testing of genetic traits from relevant biological data/samples.
Reading/Reference Lists *[4]	**Theory text/references** 1. M.W. Strickberger. Genetics. 2. P. J. Russell. iGenetics- A Molecular Approach. 3. A.J.F. Griffiths, S.R. Wessler, R.C. Lewontin, S.B. Carroll. An Introduction to Genetic Analysis. 4. E.J. Gardner, M.J. Simmons, D.P. Snustad. Principles of Genetics. 5. T.A. Brown. Genomes 3. **Practical text/references** 1. Sharma A and Sharma A. Chromosome Techniques (3rd Edition) Butterworth and Co (Ltd) Publishers. 2. D. J. Balding, M. Bishop, C. Cannings. Handbook of Statistical Genetics; John Wiley & Sons, Ltd.

Evaluation	**Theory (60)** CIA- 10 Assignment – 02 Attendance - 03 Semester Exam- 45	**Practical (40)** CA- 30 Attendance - 02 Semester Exam- 08
Paper Structure for Theory Semester Exam	**Module A (30 marks)** Any three out of four questions: Each of 2 marks Any three out of four questions: Each of 8 marks with subparts [No sub-part will be less than 2 marks or more than 6 marks] **Module B (15 marks)** Compulsory objective questions: 5 x 1= 5 marks Any two out of three questions: 2 x 5 = 10 marks [No sub-part will be more than 4 marks]	