Course	**Discipline Specific Core**
Semester	III
Paper Number	**MBTCR3052T & MBTCR3052P**
Paper Title	**GENETICS**
No. of Credits	6
Theory/Composite	Composite
No. of periods assigned	4 Theory + 3 Practical
Course description/objective	The course aims to 1. impart a comprehensive understanding of the principles of genetics and the modes of inheritance including allelic and non-allelic interactions. 2. provide an overview of the basic structure and function of chromosomes. 3. provide a comprehensive idea about genetic linkage, crossing over and chromosome mapping 5. introduce students to DNA damage and mutation. 6. thereafter introduce students to various DNA damage repair pathways and their detailed mechanisms. 6. enable students use their knowledge of genetics to analyze pedigrees and predict genotypes and phenotypes.
Syllabus	**Theory** **Module A: (35 marks)** **UNIT I: Introduction:** Historical developments in the field of genetics. Organisms suitable for genetic experimentation and their genetic significance. Cell Cycle: Mitosis and Meiosis: Role of meiosis in life cycles of organisms. Control points in cell-cycle progression in yeast. Mendelian genetics: Mendel's experimental design, monohybrid, di-hybrid and tri-hybrid crosses, Law of segregation & Principle of independent assortment. Verification of segregates by test and back crosses. Chromosomal theory of inheritance. Allelic interactions: Concept of dominance, recessiveness, semidominance, incomplete dominance, co-dominance, pleiotropy, multiple allele, pseudo-allele, essential and lethal genes, penetrance and expressivity. Non-allelic interactions: Interaction producing new phenotype, complementary genes, epistasis (dominant & recessive), duplicate genes and inhibitory genes. Sex determination and sex linkage: Mechanisms of sex determination, Environmental factors and sex determination, sex differentiation, Barr bodies, dosage compensation, genetic balance theory, sex influenced dominance, sex limited gene expression, sex linked inheritance. **UNIT II: Chromosome and genomic organization:** Eukaryotic nuclear genome nucleotide sequence composition – unique & repetitive DNA, satellite DNA. Centromere and telomere DNA sequences, middle repetitive sequences – VNTRs, STRs & dinucleotide repeats, repetitive transposed sequences - SINEs & LINEs, middle repetitive multiple copy genes, noncoding DNA. Genetic organization of prokaryotic and viral genome. Structure and characteristics of bacterial and eukaryotic chromosome, chromosome morphology, concept of euchromatin and heterochromatin. packaging of DNA molecule into chromosomes, chromosome banding pattern, karyotype, giant chromosomes, one gene one polypeptide hypothesis, concept of cistron, exons, introns, genetic code, gene function. **UNIT III: Chromosome mutations:** Variations in chromosome

	structure: deletion, duplication, inversion and translocation (reciprocal and Robertsonian), position effects of gene expression. Variations in chromosome number: Aneuploidy and Euploidy. Chromosomal aberrations in human beings. **UNIT IV: Genetic linkage, crossing over and chromosome mapping:** Linkage and Recombination of genes in a chromosome, crossing over, Cytological basis of crossing over, Crossing over at four strand stage, mechanism of crossing over. Multiple crossing overs, Genetic mapping. Extra chromosomal inheritance: Rules of extra nuclear inheritance, maternal effects, maternal inheritance, cytoplasmic inheritance, organelle heredity, genomic imprinting, Fragile-X-syndrome and chromosome. **No. of Classes:** 3 classes / week
	Module B: (15 marks) **UNIT V: Gene mutations: Definition and types of mutations, causes of mutations, Ames test for mutagenic agents, screening procedures for isolation of mutants and uses of mutants. DNA damage and repair: causes and types of DNA damage, Mechanisms of DNA repair - Photoreactivation, Base excision repair, Nucleotide excision repair, Mismatch repair, Translesion synthesis, Recombinational repair, Nonhomologous end joining.** **No. of Classes: 1 Class per week** **Practical** **1. Permanent and temporary mount of mitosis.** **2. Permanent and temporary mount of meiosis.** **3. Mendelian deviations in dihybrid crosses** **4. Demonstration of Barr Body localization, mitotic index.** **5. Karyotyping with the help of photographs** **6. Practical problems on genetics (analysis of Mendelian traits, pedigree charts and common characters like blood group, color blindness, PTC tasting, etc).** **7. Study of polyploidy in onion root tip by colchicine treatment.**
Readings	**1. M.W. Strickberger. Genetics.** **2. E.J. Gardner, M.J. Simmons, D.P. Snustad. Principles of Genetics.** **3. P. J. Russell. iGenetics- A Molecular Approach.** **4. A.J.F. Griffiths, S.R. Wessler, R.C. Lewontin, S.B. Carroll. An Introduction to Genetic Analysis.** **5. T.A. Brown. Genomes 3.**

Evaluation	**Theory: Continuous Internal Assessment: 10 marks End-Semester Theory Examination: 50 marks** **Practical: Continuous Internal Assessment: 32 marks End-Semester Examination: 8 marks**
Paper Structure for End Sem Theory	**Module A (35 marks)** **Compulsory objective questions: 1 x 5 = 5 marks** **Any three from five subjective questions with subparts: 10 x 3 = 30 marks.** **(No sub-part will be less than 1 mark or more than 6 marks)** **Module B (15 marks)** **Compulsory objective question: 1 x 5= 5 marks** **Any two out of three questions: 2 x 5 = 10 marks (No sub-part will be more than 4 marks)**