



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Science

Level: Under Graduate

Branch Name: Honors/ Honors With Research (Biotechnology)

Course / Subject Code: BS03001011

Course / Subject Name: Genetics

W.e.f. Academic Year:	2025-26
Semester:	3
Category of the Course:	Core Courses

Prerequisite: Students must have studied biology in previous classes. They have basic knowledge about the variation, heredity and evolution.

Rationale: This course is structured to help in understanding the concept of genetics of living organisms. This will give detail about inheritance of genes, which have importance in resolving the medical and other issues at genetic level.

Course Scheme:

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
L	T	P		Theory		Practical		
			ESE (E)	PA(M)	ESE (V)	PA (I)		
3	0	2	4	70	70	30	30	200

Course Content:

Sr. No.	Course Content	No. of Hours	% of Weightage
1	Introduction and Mendelian Inheritance Historical developments in the field of genetics, Mendel's experimental organism and its significance, Mendel's experimental design, monohybrid, di-hybrid and tri hybrid crosses, Law of segregation & Principle of independent assortment, Test and back crosses. Chromosomal theory of inheritance (Sutton-Boveri). Applications of Mendel's Principles (Punnett square method, Forked-line method, Probability method), Pedigree, Symbols used in pedigree studies.)	10	22
2	Interaction of Genes Allelic interactions: Concept of dominance, recessive, Concept of pseudo-alleles, Co-dominance, Incomplete dominance, Pleiotropy, Penetrance, Expressivity (Example of each), lethal allele. Non allelic interactions: Epistasis (dominant & recessive), Duplicate gene action (15:1), Complementary gene action (9:7), Supplementary	5	11



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	gene action (9:3:4), Inhibitory gene action (13:3), Masking gene action (12:3:1), Polymeric gene action (9:6:1), Additive gene action (1:4:6:4:1), Molecular basis for gene interaction		
3	Genetic linkage, Crossing over and Chromosomal aberrations Introduction, Chromosome theory of Linkage, Coupling and Repulsion phase, Types of Linkage, Linkage groups and Linkage maps. Recombination of genes in a chromosome crossing over, Molecular mechanism of crossing over. Genetic disorders, Alteration in chromosome structure - Deletions, duplications, inversions and translocations, alterations in chromosome number - Ploidy-Aneuploidy and Euploidy	15	33
4	Basics of microbial genetics Introduction to microbial genetics, methods of gene transfer in bacteria: transformation, Transduction and Conjugation, mitotic recombination	5	11
5	Population Genetics, mutations and their effect on evolution Hardy – Weinberg law and its applications, Factors affecting allele frequencies, selection, mutation, migration and genetic drift, inbreeding and outbreeding, Quantitative Genetics, C-value. Spontaneous and Induced mutations, and its role in evolution, Radiation injury and DNA repair mechanisms, Relationship between Mutations and Phenotypes, genetic toxicity testing.	10	22

Textbook:

- Principles of Genetics 5th ed. And 6th ed., Snustad, D.P. and Simmons, M.J., John Wiley & Sons Asia, 2010.
- Genetics. P.S.Verma and V.K. Agarwal, S. Chand and Company, New Delhi. 2000.

Reference Books:

- Genetics. P. K. Gupta, Rastogi Publications. ISBN: 81-7133-779-1. Shivaji Road Meerut, India.
- Fundamentals of Genetics. (2004), B.D. Singh, Kalyani Publishers. (ISBN: 81-272-1331-4)
- Principles of Genetics by Gardener, John Wiley & Sons, New York, USA, (ISBN 9971-51-346-3)

Course Outcome:

After Completion of the Course, Student will able to:

Sr. No	Course Outcomes	RBT Level
1	Learn Mendelian Genetics, Mendel's law of segregation, Independent assortment, pedigree	UN,RM,AP



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2	Will get knowledge of Gene interaction at different level, dominant and recessive gene.	UN,RM,AP
3	Develop concept of linkage of gene and its exchange during crossing over and extra chromosomal Inheritance.	UN,RM,AP
4	Develop concept of chromosomal aberrations, Hardy Weinberg law, and evolutionary genetics	UN,RM,AP

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

List of Experiments:

1. Blood Group Typing and Inheritance of ABO Blood Groups
2. Chi-square Test for Genetic Cross Data
3. Karyotyping for Chromosomal Abnormalities
4. Pedigree Analysis with Human Traits
5. Microscopy of Polytene Chromosomes in Drosophila Salivary Glands
6. Observation of Mitosis in Onion Root Tips
