Faculty of Science
Bachelor of Science
(W. E. F.: 2023-24)
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Name of Faculty	:	Faculty of Science
Name of Program	:	Bachelor of Science
Course Code	:	2BSB01
Course Title	:	Genetics
Type of Course	:	Professional Core
Year of Introduction	:	2023-24

Prerequisite	:	Recall the basic genetics terms.
Course Objective	:	By the end of this course, students should have a solid understanding of genetic principles, mechanisms, and applications. They should be capable of applying genetic concepts to solve problems, critically analyzing genetic information, and understanding the ethical considerations surrounding genetic research and technologies. Additionally, students should be prepared to engage with genetics-related topics in further academic pursuits or careers in genetics, biotechnology, medicine, and related fields.
Course Outcomes	:	At the end of this course students will be able to:
	CO1	Evaluate applications of genetic engineering in biotechnology, agriculture, medicine, and forensics.
	CO2	Understand the historical development of genetics as a scientific discipline and recognize key contributors.
	CO3	Recognize different types of mutations, understand their causes, and assess their impact on protein function.
	CO4	Analyze the principles of recombinant DNA technology, including DNA cloning, plasmids, and restriction enzymes.
	CO5	Recall the structure and organization of chromosomes and comprehend the concept of homologous chromosomes.

Teaching and Examination Scheme

Teaching Scheme (Contact Hours)			Credits	Examination Marks				
				Theory Marks		Practical Marks		Total Marks
L	**T**	**P**	**C**	**SEE**	**CIA**	**SEE**	**CIA**	
3	0	2	4	50	25	50	25	150

Legends: ***L****-Lecture;* ***T****–Tutorial/Teacher Guided Theory Practice;* ***P*** *– Practical,* ***C*** *– Credit,* ***SEE*** *– Semester End Examination,* ***CIA*** *- Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

Unit No.	Topics	Teaching Hours	Weightage	Mapping with COs
1	**Introduction to Genetics and Mendelian Inheritance** Historical overview of genetics and key contributors. Mendel's laws of inheritance: Law of Segregation and Law of Independent Assortment. Monohybrid and dihybrid crosses: Predicting genotypic and phenotypic ratios. Pedigree analysis: Patterns of inheritance in human traits and disorders.	10	22%	CO2
2	**Chromosomal Basis of Inheritance and Linkage** Chromosome structure and organization: Homologous chromosomes, chromatids, and centromeres. Sex determination and sex-linked inheritance. Crossing-over and genetic recombination. Gene mapping: Linkage maps and genetic linkage analysis.	10	22%	CO5
3	**Molecular Genetics and Genetic Variation** DNA structure and replication: Watson and Crick's model. Transcription and translation: Central dogma of molecular biology. Genetic code: Codons, anticodons, and the role of tRNA. Mutations: Types, causes, and consequences on protein function	10	22%	CO3
4	**Genetic Regulation, Genetic Engineering, and Genomics** Gene regulation: Operons, transcription factors, and epigenetic mechanisms. Recombinant DNA technology: DNA cloning, plasmids, and restriction enzymes. Applications of genetic engineering: GMOs, gene therapy, and DNA fingerprinting. Genomics: Human genome project, comparative genomics, and bioinformatics.	15	34%	CO1 CO4

Suggested Distribution of Theory Marks Using Bloom's Taxonomy						
Level	Remembrance	Understanding	Application	Analyse	Evaluate	Create
Weightage	**40**	**20**	**-**	**20**	**20**	**-**

NOTE: This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Suggested List of Experiments

Sr. No.	Name of Experiment	Teaching Hours
1.	Introduction to Microscopy: Learn how to use a light microscope to observe different types of cells.	02
2.	Perform a monohybrid cross with model organisms (e.g., fruit flies or pea plants) to understand Mendel's Law of Segregation.	02
3.	Conduct a dihybrid cross to explore Mendel's Law of Independent Assortment.	02
4.	Analyze real or simulated pedigrees to determine the inheritance pattern of a genetic trait or disorder.	02
5.	Introduce mutations into a specific gene and analyze the effects on protein structure and function.	02
6.	Simulate DNA replication using model kits or digital tools.	02
7.	Examine and compare karyotypes of different organisms to understand chromosome structure.	02
8.	Use Drosophila fruit flies to demonstrate genetic mapping and linkage.	02
9.	Investigate sex-linked traits by performing a cross involving a sex-linked gene.	02
10.	Analyze DNA fragments or proteins using agarose or polyacrylamide gel electrophoresis.	02
11.	Explore gene regulation by conducting experiments with the lac operon in E. coli.	02
12.	Analyze genomic data sets to identify genes, mutations, or regulatory elements.	02
13.	Use bioinformatics tools to predict protein structures, analyze genetic sequences, or perform comparative genomics studies.	02
14.	Perform a PCR experiment to amplify a DNA fragment.	02
15.	Analyze DNA samples to create a DNA fingerprint for identification purposes.	02

Major Equipment /Instruments

Sr. No.	Name of Major Equipment/ Instruments and Software
1	Analytical Balance
2	Autoclave
3	Micropipettes
4	Stains
5	Light Microscope
6	Anaerobic jar
7	UV Chamber
8	Hot Air Oven
9	Centrifuge
10	PCR
11	Electrophoresis.

Suggested Learning Websites

Sr. No.	Name of Website
1	https://archive.nptel.ac.in/courses/102/101/102101072/
2	https://archive.nptel.ac.in/courses/102/101/102101050/

Reference Books

Sr. No.	Name of Reference Books
1	"Essential Genetics: A Genomic Perspective" by Daniel L. Hartl
2	Genetics: Analysis of Genes and Genomes" by Daniel L. Hartl and Elizabeth W. Jones
3	"Genetics: From Genes to Genomes" by Leland H. Hartwell, Michael L. Goldberg, Janice A. Fischer, and Leroy Hood
4	Principles of Genetics" by D. Peter Snustad and Michael J. Simmons
5	""Introduction to Genetic Analysis" by Anthony J.F. Griffiths, Susan R. Wessler, Sean B. Carroll, and John Doebley
6	Genetic Analysis: An Integrated Approach" by Mark F. Sanders and John L. Bowman
7	"Genetics Essentials: Concepts and Connections" by Benjamin A. Pierce
8	"Molecular Biology of the Gene" by James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, and Richard Losick
9	"Genetics: A Conceptual Approach" by Benjamin A. Pierce
10	"Essential Genetics: A Genomic Perspective" by Daniel L. Hartl
11	"Genetic Analysis: An Integrated Approach" by Mark F. Sanders and John L. Bowman