Course Code	Course Name	Credits
26ZY004	PRINCIPLES OF GENETICS	04

Course Objectives

- To introduce the fundamental principles and historical development of genetics.
- To understand Mendelian inheritance, gene interactions, and multiple alleles.
- To explain the concepts of linkage, crossing over, and cytoplasmic inheritance.
- To study chromosomal aberrations, gene mutations, and their biological significance.
- To provide knowledge on mechanisms of sex determination and sex differentiation.

Learning Outcomes

- Explain the basic principles of heredity and Mendelian genetics.
- Analyze patterns of inheritance involving multiple alleles and gene interactions.
- Understand the mechanisms of linkage, crossing over, and genetic mapping.
- Differentiate various chromosomal abnormalities and gene mutations and their significance.
- Describe different mechanisms of sex determination and dosage compensation in organisms.

Unit 1 – History of Genetics (12 Hrs.)

Pre- Mendelian genetic concepts; Concepts - Phenotype and Genotype; Heredity, variation. Biography of Mendel; Mendelian experiments on pea plants - Law of Dominance, Law of Segregation; Monohybrid cross, Backcross and Test cross, genetic problems related. Law of Independent Assortment: Dihybrid cross in pea plant, Backcross and Test cross, genetic problems related.

Unit 2 – Multiple Alleles & Gene Interactions (12 Hrs.)

Multiple Alleles: Definition, ABO blood groups and Rh factor in Human. Gene Interactions: Deviations from Mendelism: Incomplete inheritance and Codominance. Inter allelic - Complementary gene interaction (9:7) - Lathyrus odoratus. Supplementary gene interaction (9:3:4) - Grain color in Maize. Epistasis - Dominant Fruit color in Cucurbita pepo, Recessive - Coat color in Mice. Non- Epistasis - Comb pattern in Poultry.

Unit 3 - Linkage and Extra nuclear inheritance (12 Hrs.)

Linkage: Definition, Linkage group- Drosophila, Types of Linkage-Complete linkage and Incomplete linkage, Factors affecting linkage. Significance of linkage. Extra nuclear inheritance: Characteristic features of Cytoplasmic Inheritance, Mitochondrial DNA, Chloroplast DNA, Sigma factor in Drosophila, Shell coiling in snail. Cytoplasmic Male Sterility (CMS) in Maize.

Unit 4 – Crossing over and Epistasis (12 Hrs.)

Crossing over: Definition and Types - Germinal and Somatic crossing over - Drosophila. Molecular mechanism of crossing over. Interference and coincidence, Significance of crossing over. Epistasis - Dominant Ex.: Fruit color in Cucurbita pepo, Recessive Inheritance - Coat color in Mice. Non- Epistasis - Comb pattern in Poultry.

Unit 5 - Sex Determination (12 Hrs.)

Chromosome theory of Sex determination: Gynandromorphs. Extra Chromosomal Inheritance: Characteristic features of Cytoplasmic Inheritance; Inheritance of Mitochondrial DNA, Chloroplast DNA, Kappa particles in Paramecium, Sigma factor in Drosophila, Shell coiling in snail.

Reference Books:

1. Advanced Genetics. G. S. Miglani. Alpha Science International, Ltd. 2012.
2. Cell and Molecular Biology, 4th Edition, P.K. Gupta. 2014
3. Fundamentals of Biostatistics. 2nd Edition. Khan & Khanum. 2004. Ukaaz publications.
4. Genes- IX, 9th Ed., Benjamin Lewin. Jones and Bartlett Publishers, 2008.
5. Genetics – Classical to modern, 1st Edition. P.K. Gupta. 2013.

Websites and eLearning Sources:

https://openstax.org/details/books/biology-2e
https://www.biologydiscussion.com/genetics
https://www.easybiologyclass.com/category/genetics/