Course Code	Course Name	Credits
26ZY502	INHERITANCE BIOLOGY	04

Course Objectives

- To understand the basic principles and patterns of biological inheritance.
- To study Mendelian and non-Mendelian inheritance mechanisms.
- To acquire knowledge on chromosomal behavior and genetic variation.
- To understand molecular basis of heredity and gene expression.
- To develop awareness of the applications of inheritance biology in medicine, agriculture and biotechnology.

Learning Outcomes

- Explain the fundamental concepts and laws of inheritance biology.
- Differentiate between Mendelian and non-Mendelian inheritance patterns.
- Describe chromosomal abnormalities, mutations and genetic variations.
- Discuss the molecular mechanisms of gene expression and heredity.
- Apply genetic principles in understanding human diseases, breeding and biotechnology.

Unit 1 – History of Genetics (12 Hrs.)

Pre- Mendelian genetic concepts: Biography of Mendel and his experiments on pea plants. Law of Dominance. Law of Segregation: Monohybrid cross, Back cross and Test cross. Law of Independent Assortment: Dihybrid cross in pea plant.

Unit 2 – Multiple Alleles and 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 crossing over (12 Hrs.)

Linkage: Definition, Linkage group- Drosophila, Types of Linkage-Complete linkage and Incomplete linkage, Factors affecting linkage. Crossing over: Definition and Types - Germinal and Somatic crossing over. Drosophila, Maize. Extra nuclear inheritance: Characteristic features of Cytoplasmic Inheritance, Sigma factor in Drosophila, Shell coiling in snail. Cytoplasmic Male Sterility (CMS) in Maize.

Unit 4 – Chromosomal Aberrations (12 Hrs.)

Numerical: Euploidy (Monoploidy, Haploidy and Polyploidy) Polyploidy-Autopolyploidy and Allopolyploidy. Aneuploidy- Monosomy, Nullisomy and Trisomy. Structural – Deletions - (Terminal, Interstitial), Duplications- (Tandem, Reverse tandem and Displaced), Translocations- (Simple, Isochrome, Reciprocal, Displaced) and Inversions (Pericentric and Paracentric). Significance of chromosomal aberrations. Gene Mutation: Types- Transitions and Transversions, Substitution Mutations, Missense, Non-sense, Silent and Neutral Mutations. Frameshift- Insertion and Deletion Mutations. Induced and spontaneous Mutations. Significance of Gene mutation.

Unit 5 - Sex Determination (12 Hrs.)

Chromosome theory of Sex determination: XX- XY, XX-XO, ZZ-ZW, Genic balance theory of Bridges, Intersexes and Super sexes in Drosophila, Y chromosome in sex determination of Melandrium. Environment and sex determination. Hormonal control of Sex determination (Free martins). Gynandromorphs. Dosage compensation in Drosophila, Coenorhabditis elegans and Man (Lyon's hypothesis). Sex differentiation in Drosophila and Man.

Reference Books:

1. Benjamin Pierce, (2015) Genetics- A Conceptual Approach, 5th edition, WH Freeman publication
2. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition.
3. Benjamin Cummings. Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition.
4. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
5. Fletcher H. and Hickey I. (2015). Genetics. IV Edition. GS, Taylor and Francis Group, New York and London.

Websites and eLearning Sources:

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