DISCIPLINE SPECIFIC CORE COURSE 15–:
Fundamentals of Genetics
Zoo-DSC-15

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
Fundamentals of Genetics Zoo-DSC-15	04	02	Nil	02	Passed Class XII with Biology/ Biotechnology	NIL

Learning Objectives

The learning objectives of this course are as follows:

- to be able to list some of the distinguishing features of prokaryotes versus eukaryotes.
- to provide an understanding of the basic patterns of inheritance.
- to explain how genotype is related to phenotype?
- to describe how a mutation can change the phenotype.

Learning Outcomes

By studying this course, students will be able to

- Enhance knowledge of the basic principles of inheritance.
- Develop analytical skills and critical thinking through pedigree analysis.
- Understand the mechanism of gene transfer and mapping in both prokaryotes and eukaryotes.
- Learn the mechanisms of mutations and harmful and beneficial effects of mutagens, which help evolve new species over time.
- Be able to grasp basic concepts of human chromosomal disorders.

SYLLABUS OF DSC-15

UNIT- 1: Mendelian Genetics and its Extensions **7 hrs**

Principles of inheritance, Incomplete dominance and co-dominance, Multiple alleles, Lethal alleles, penetrance and expressivity, Epistasis, Phenocopy, Pleiotropy, Polygenic Inheritance, Sex-linked, Sex-influenced, and Sex-limited characters inheritance.

UNIT- 2: Linkage, Crossing Over and Chromosome Mapping **6 hrs**

Linkage and crossing over, Cytological basis of crossing over, Recombination frequency

as ameasure of linkage intensity, two-factor and three-factor crosses, Linkage map, Coefficient of Coincidence and Interference, Gene mapping by Somatic cell hybridization.

UNIT- 3: Mutations **8 hrs**

Types of gene mutations, Detection of mutations in *Drosophila*: CLB method, Mutagens: Physical and chemical, molecular basis of spontaneous and induced mutations, Chromosomal aberrations: Structural Variations in chromosomes, Aneuploidy & Polyploidy.

UNIT- 4: sex Determination **3 hrs**

Basis of sex determination: Genetic and environmental; Sex determination in *Drosophila* and human; Mechanism of dosage compensation.

UNIT- 5: Extra-chromosomal Inheritance **3 hrs**

Comparison of nuclear and extranuclear inheritance; Organelle inheritance: Antibiotic resistance in *Chlamydomonas*, Infective heredity in *Paramecium*. Maternal effects: Shell coiling in *Limnaea*, pigmentations in *Ephestia.*

UNIT- 6: Transposable Genetic Elements **3 hrs**

Transposons in bacteria, Ty elements in yeast, Ac-Ds elements in maize, P elements in *Drosophila*, Transposons in humans, Significance of Transposons.

Practical **(60 hrs)**

(Laboratory periods: 15 classes of 4 hours each)

1. Simulation exercises using beads or seeds to study the gene interactions: 9:3:4; 12:3:1; 9:7; 9:3:3:1 (comb shapes in roosters) and verification of ratios by usingChi-square analysis.
2. Pedigree analysis of Autosomal Dominant trait, Autosomal recessive trait, X-linked Dominant traits, X-linked recessive traits, Y-linked traits and mitochondrial traits.
3. Use of probability in solving problems of genetics (Sum rule, Multiplication rule & Binomial expansion).
4. Gene mapping (order and distance) using data from interrupted mating experiments in bacteria.
5. Linkage maps based on data (two - point and three - point crossing over) from *Drosophila*.
6. Human Karyotypes, Human chromosomal disorders & single gene disorders.
7. Project on Epigenetic, Eugenics, Euthenics and Euphenics.

*Subject to UGC guidelines

Essential/recommended readings

1. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons In.

2. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition. Benjamin Cumming

3. Pierce, B. A. (2012). Genetics-A Conceptual Approach. IV Edition. W. H. Freeman and Company

Suggestive readings

1. Peter, J. Russell. (2009), iGenetics: A molecular approach. 3rd Edition. Benjamin Cumming

2. Anthony J.F. Griffiths, Susan R. Wessler, Richard C. Lewontin, Sean B. Carroll (2007). Introduction to Genetic Analysis. 9th Edition. W H Freeman.

NOTE: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.