



Course Title: ADVANCED GENETICS

Course Code: GCMB601

Credit Units: 04

Level: PG

L	T	P/S	FW/S W	TOTAL CREDIT UNITS
3	0	2	0	4

Course Objectives:

Theory: Genetics is pivotal to modern life sciences. Genetic principles are unifying principles applicable across all the living forms. “Gene “is central to genetics, molecular biology and genetic engineering. Therefore the basic objectives of this course are to apprise the students with both classical and molecular genetics.

Practical: To train students practically in basic and applied principles of Genetics

Pre-requisites: Graduate in Life Sciences

Student Learning Outcomes:

- The student will be able to Define the central role of genes in the inheritance of traits and the complex variations in inheritance patterns due to interaction of genes with each other and with the environment,
- The student will be able to Describe concepts such as mutation and genetic drift, and illustrate how genetic variation can result in fitness differences that may drive evolution through the process of natural selection;
- The student will be able to Compare how genes behave in populations,
- The student will be able to Develop skills in genetics techniques, problem-solving and experimental design, and in data collection, analysis and interpretation
- The student will be able to Justify further study, teaching, research and employment in genetic research or the practical applications of genetics

Course Contents/Syllabus	Weightage (%)
Module I	20%
<p>Descriptors/Topics:</p> <ul style="list-style-type: none"> ■ Mendel's laws of inheritance, alleles, inter-allelic relationships, multiple alleles, human pedigree analysis. Gene interactions, Quantitative inheritance ■ Mitosis, Meiosis and Cell cycle. ■ DNA as genetic material, Structure of DNA and RNA. Basic aspects of DNA replication. 	
Module II	20%
<p>Descriptors/Topics:</p> <ul style="list-style-type: none"> ■ Chromosomes: Types of chromosomes: Polytene and lampbrush, sex chromosomes, Karyotype , Euchromatin and Heterochromatin. Repetitive and non repetitive DNA sequences & C value paradox ■ Sex determination in plants, <i>Drosophila</i> and Humans. Dosage compensation. ■ Extranuclear inheritance: Mitochondrial and chloroplast heredity. Horizontal gene transfer 	
Module III	20%
<p>Descriptors/Topics:</p> <ul style="list-style-type: none"> ■ Linkage and crossing over, gene mapping in lower and higher eukaryotes, molecular markers and their applications in gene mapping. ■ Evolution of gene concept. Fine structure of gene: Benzers experiment with rII region of T4 bacteriophage, complementation and recombination, Gene conversion, Modern concept of gene: Promoter and coding sequences; exons and introns. Genes and pseudogenes. 	
Module IV	10%
<p>Descriptors/Topics:</p> <ul style="list-style-type: none"> ■ Bacterial genetics: conjugation and transduction, lysogenic and lytic cycles of lambda phage, specialized and generalized transduction, plasmids. 	

<ul style="list-style-type: none"> ■ Transposable elements: Transposons and retrotransposons. 	
Module V	20%
Descriptors/Topics: <ul style="list-style-type: none"> ■ Mutations, spontaneous and induced mutations. ■ Structural changes in chromosomes: Deletions, duplication, inversions and translocations. ■ Numerical chromosomal changes changes: Haploidy, polyploidy and aneuploidy. ■ Chromosomal disorders in humans. 	
Module VI	10%
Descriptors/Topics: <ul style="list-style-type: none"> ■ Poulation genetics: Hardy – Weinberg genetic equilibrium, Genetic polymorphism, causes of changes in gene frequency (migration, selection, genetic drift, inbreeding and mutations) 	
Practical: List of Experiments: <ul style="list-style-type: none"> ■ To make squash preparations of pre-treated metaphase chromosomes, and PMCs to view diplotene, diakinesis, metaphase I and anaphase I in <i>Phlox drummondii</i>, <i>Allium cepa</i> and (or) <i>Rhoeo discolor</i> ■ Preparation of karyograms from the given photographs for karyotypic formula ■ To study through photographs normal and deviant cytogenetic mechanisms ■ Study of Mendel’s laws, and deviations from Mendelian ratios using seed samples in the ratios of 9:7, 9:4:3, 13:3, 15:1, 12:3:1. Use Chi-Square Test for Testing the ratios ■ Exercises wrt determination of correct sequence and distance between the linked genes ■ Induction and recovery of mutants in bacteria by UV irradiation ■ Demonstration of induced puffing in the salivary gland chromosomes of <i>Drosophila melanogaster</i> larvae ■ Problems on quantitative genetics 	
Pedagogy for Course Delivery: The class will be taught using theory class based method. The instructor will dedicate time in showing the ways to think innovatively by making them solving theoretical problems and understand the concepts . Lectures: 44,Class Test: 1,Total: 45 Pedagogy for Course (Lab/ Practical) Delivery: The class will be taught using practical and lab based method. In addition to demonstrating the practical the	

instructor will dedicate time in making the student to understand the concepts through slides and worksheets. The instructor will make student think practically and get ready for solving real life /field problems in solving inheritance mechanisms.

Practical: 28,Class Test: 2,Total: 30

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	Total
75	25	100

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment						
Components (Drop down)	Mid-Term Exam	Project	Viva	Attendance	End Term Examination	Total
Weightage (%)	10	10	5	5	70	100

Lab/ Practical/ Studio Assessment:

	Continuous Assessment/Internal Assessment				End Term Examination			
Components (Drop down)	Class test	Lab record	Viva	Attendance	Performance	Lab Record	Viva	Total
Weightage (%)	15	5	5	5	40	10	20	100

Text & References:

- 📖 Griffiths A.J.F, Wessler S.R, Carroll S.B and Doebley J. 2012. Introduction to Genetic Analysis. W.H. Freeman and Co., NewYork
- 📖 Snustad D.R and Simmons M.J. 2009. Principles of Genetics. John Wiley and Sons
- 📖 William S.K, Michael R.C, Charlotte A.S and Michael A.P. 2008. Concepts of Genetics. Benjamin – Cummings Pub Co.
- 📖 Hartl D.L and Jones E.W. 2006. Essential Genetics. A Genomics Perspective. Jones and Bartlett Publishers, London

Any other Study Material:

- 📖 Research Papers and Review Articles Published in Peer-Reviewed Scientific Journals

Remarks and Suggestions:

Date:

Name, Designation, Organisation