Birla Institute of Technology & Science, Pilani
Hyderabad Campus

SECOND SEMESTER 2024-25
(Course Handout Part II)

Date: 01/01/2025

In addition to Part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. **: BIO F243**
Course title **: Genetics**
Instructor-in-charge **: K. NAGA MOHAN**

1. Scope and objective of the course:

Facts and theories of heredity, their relation to the present state of biological theory in general; elements of population genetics; genetics and species concept. The students will learn on various patterns of inheritance of biological traits, influences of one locus on the other, outcome of the phenotypes, variations of alleles in populations and their significance, molecular basis of genetic regulation and developmental switches.

2. Text Books:

(1) Principles of Genetics-Robert H. Tamarin Seventh Edition; Tata McGraw-Hill, 2002.

3. Reference Books:

(1) Introduction to Genetic Analysis, Anthony Griffths, Susan Wessler, Richard Lewontin and Sean Carroll, Ninth Edition, W.H. Freeman Co., 2007.

4. Course Plan:

Lecture No.	Learning Objectives	Topics to be covered	Textbook Chapter
1	Introduction to genetics	Brief overview of modern Genetics	1
2-4	To understand the outcome of ratios of phenotypes determined by single locus, multiple loci and due to intergenic interactions.	Mendelian genetics: Laws of inheritance Gene interaction, Multiple alleles Inborn errors of metabolism, One Gene one enzyme hypothesis	2
5-9	Linkage and mapping in Eukaryotes: Understand how genes are organized in the chromosomes, how the distance between genes influences the phenotypic ratios, calculate the genetic distances between genes and deduce genetic maps	Diploid mapping; Two-point test cross, Three-point test cross, Haploid Mapping (tetrad analysis), Somatic Crossing over.	6
10-11	Linkage and Mapping in Prokaryotes and Bacterial Virus: Understanding the difference in ploidy and mechanisms of transfer of genes in bacteria and viruses	Bacterial transformation: detection, competence, DNA uptake, transforma-tion mapping, Bacterial conjugation: Hfr transfer, recombination in recipient cells, conjugation mapping. Genetic recombination in phages, Transduction: DNA transfer, co-transduction and linkage mapping, mapping by co-transduction	7

12-15	Population genetics: A mathematical approach to understand how gene frequencies in populations are used to estimate processes such as mutation rate, speciation and migration	Hardy-Weinberg Equilibrium and Mating Systems, Processes that change allele frequencies	19-20
16-18	Non-nuclear inheritance: An understanding of unique patterns of non-Mendelian inheritance	Maternal effects and cytoplasmic inheritance, epigenetic inheritance	17
19-20	Cytogenetics	Chromosomal aberrations, anomalies in chromosomal numbers, varying ploidy levels.	8 & study material
21-23	Distinguish the chemical composition of DNA and RNA, study the mechanism of perpetuation of genetic material	Nucleic acids and their structures, super-coiling, DNA replication, DNA polymerases, Replication in prokaryotes and eukaryotes	9
24-27	Organization of genetic material in Eukaryotes: A basic understanding of how eukaryotic genomes are organized and how the genome is packaged in an orderly manner within the nucleus	Packaging of DNA in eukaryotes, Repetitive and unique sequences, Split genes, Overlapping genes	15
28-31	DNA Mutation, Repair and Recombination: Identify how mutations in DNA occur, their consequences and mechanisms of overcoming the mutagenic effects	Fluctuation Test, Genetic Fine Structure, Spontaneous Vs Induced Mutation, DNA Repair; Damage reversal, Excision repair, Double Strand Break Repair Recombination; DS Break Models, Bacterial Recombination, Hybrid DNA	12
32-35	Expression of gene: Detailed information on the flow of genetic information and epigenetic modifications	Transcription in prokaryotes and eukaryotes, RNA splicing, RNA editing and ribozymes. Translation in prokaryotes and eukaryotes. What constitutes epigenetics and several epigenetic modifications.	10-11
36-38	Regulation of gene expression in Prokaryotes: Outlines basic principles of constitutive and induced expression of genes and decisions taken by bacteriophage lambda during infection of *E.coli*	Gene Expression Control in Prokaryotes; Operon Model, *lac* and *trp* operons and Lytic and Lysogenic cycles in Phage -λ, Post transcriptional Regulation.	14
39-40	Regulation of gene expression in Eukaryotes: Basic outline of how complex regulatory mechanisms influence gene expression patterns in eukaryotes	Control of Transcription in Eukaryotes; Chromatin remodeling, Specific transcription factors, Methylation of DNA, Transposable Genetic Elements, Cancer Genetics	16

5. Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of component
Mid-semester	90 min	25	March 03, 2025 (2:00 PM – 3:30 PM)	Closed Book (50 M)
Assignments	-	20	● Announced ● No Makeup ● Writeups with plagiarism >15% will attract negative marking.	Open Book (40 M)

			● Writeups submitted after the due date will not be considered.	
Quizzes	-	15	● Surprise ● No Makeup. ● The subset of quizzes with top marks scored by a student will be considered.	Closed Book (30 M)
Comprehensive Exam	180 min	40	May 02, 2025 (Forenoon)	Closed Book (80 M)

A minimum of 30% of the highest score obtained or 40% of the median score, whichever is lower, is required to clear the course.

6. Chamber consultation hour: Mondays 6 PM – 7 PM.

7. Notices: Will be displayed on the Course Management System (CMS).

8. Make-up policy: Make-up will be granted only if the candidate is sick and hospitalized. This needs to be certified by the Campus Doctor. As per the clause 4.07 in the Academic regulations booklet.

9. Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

INSTRUCTOR-IN-CHARGE
(BIO F243)