Course Code	BIO601
Course Name	Foundations of Modern Biology
Credits	4
Course Offered to	UG/PG - Core
Course Description	The aim of this basic core course is to provide students a good background in genetics and molecular biology. The major focus is to a) cover most important concepts in genetics like Mendelian laws, linkage and recombination b) cover molecular mechanisms of gene expression and c) solve qualitative and quantitative problems in population and evolutionary genetics.

Pre-requisites

Pre-requisite (Mandatory)	Pre-requisite (Desirable)	Pre-requiste (Other)
None		None

Post Conditions

CO1	CO2	CO3	CO4
Students are able to build simple probabilistic model for Mendelian and non-Mendelian genetics. Students are able to solve problems on mitosis, recombination and cross-overs.	Students are able to construct and analyze pedigree charts and solve problems in linkage equilibrium, and population genetics	Students are able to solve problems in molecular mechanisms of gene expressions like replication, transcription and translation of genes.	Students are able to build simple mathematical models to understand gene regulatory networks of transcriptional and translation processes.

Weekly Lecture Plan

Week Number	Lecture Topic	CO s met	Assignments/Lab/Tutorials
Week 1-2-3	(i) An Introduction to the Science of Genetics, How Genes are organized and transmitted through generations. (ii) Cell division cycle: Mitosis (iii) Cell division cycle: Meiosis	CO1,CO2	organization of transcription factors in chromosome by F. Kepes. : (ii) Modeling mitosis and embryonic cell cycle using ODE and simulating using MATLAB (iii) Understanding the importance of crossing over and recombination in cell cycle with respect to genetic diversity.
Week 4-5-6	Transmission Genetics: Mendelian Analysis of Inheritance Genes, Chromosomes, single allele interactions etc. Mechanism of Mendelian Inheritance	CO1,CO2	Assignment: Understanding Mendelian laws and relating the laws to chromosomal theory of inheritance. Mathematical models to analyze Mendelian inheritance. Construction of Punnett square and linked genes for monohybrid cross.Probabilistic analysis of Mendelian genotypic and phenotypic ratios and construction of linked genes for multihybrid cross.
Week 7-8-9	Multiple Alleles and Gene Interactions Pedigree analysis Linkage and Gene Mapping in Eukaryotes, Extranuclear Inheritance,	C02	Problem solving in epistasis and non-Mendelian ratios. Understanding the biochemical interactions in genetic pathways. Data analysis using statistical chi-square test to understand deviations from Mendelian ratios.Assignment given to train students in the construction of pedigree charts for various traits and identification of autosomal dominant, recessive, x-linked autosomal and dominant patterns from the charts. Single and double cross over problems solved to make student understand linkage, and how Mendelian laws are not followed.
Week 10	Genes function At the Molecular Level, The Physical Nature of DNA: Structure and Replication, The Molecular Structure of Prokaryotic and Eukaryotic Chromosomes.	CO3	Assignment given to understand various types of mRNA processing
Week 11-12-13	Translation, and the Genetic Code Hierarchies of Genetic Regulation	C04	Assignment given to understand how coding of proteins by various processes takes place.

Assessment Plan

Type of Evaluation	% Contribution in Grade
Mid-sem	25
End-sem	25
Assignments	15
Quiz	20
Project	15

Resource Material

Type	Title
Textbook	B. Pierce, Genetics: A conceptual approach
Textbook	Watson et al., Molecular biology of Gene