

COURSE 8: - CELL BIOLOGY AND GENETICS
credits - 3

I. Course Outcomes:

By the Completion of the course the learner should be able to–

1. Understand cell theory, cell organelles, the cell cycle, and the role of the cytoskeleton.
2. Students will comprehend the structure and functions of the cell membrane, nuclear envelope, and nucleolus, as well as gain basic knowledge of cancer development.
3. Learn about protein sorting, intracellular signal transduction pathways, programmed cell death, stem cells, and specialized chromosomes.
4. Gain knowledge of Mendelian genetics, including mono-hybrid and dihybrid crosses, inheritance patterns, and allele frequencies.
5. Understand the concepts of linkage, crossing over, the Hardy-Weinberg Law, natural selection, genetic drift, and the mechanisms of sex determination and inheritance.

Unit 1 Hours : 09

1. Cell theory and cell organelles (Mitochondria, Chloroplasts, Lysosomes, Glyoxysomes and Peroxisomes, Golgi apparatus and ER).
2. Cell cycle and its regulation.
3. Cytoskeleton: Structure and organization of actin, myosin and intermediate filaments, microtubules, and their role.

Unit 2 Hours : 09

1. Structure and functions Cell membrane, proton pumps associated (Na-K, Calmodulin etc. and their distribution), phagocytosis, pinocytosis, exocytosis.
2. Nuclear envelope, structure of nuclear pore complex, nuclear lamina, transport across nuclear membrane, Nucleolus.
3. Elementary knowledge of development and causes of cancer; Oncogenes and suppressor genes,

Unit 3 Hours : 09

1. Protein sorting and Transport Intracellular signal transduction pathways (GPCR , ERK Pathway, mTOR Signaling)
2. Programmed Cell Death; Stem cells.
3. Specialized chromosomes (polytene, lampbrush)

UNIT 4 Hours : 09

1. Mendelian Genetics , Mono hybrid and Dihybrid cross , Law of dominance segregation and Independent assortment.
2. Chromosome theory of inheritance, Pedigree analysis, Incomplete dominance and co-dominance,

3. Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Allele frequencies, Genotype frequencies.

Unit – 5 Hours : 09

1. Linkage and Crossing over, Molecular mechanism of crossing over. Recombination frequency as a measure of linkage intensity,
2. Hardy-Weinberg Law, role of natural selection, Genetic drift. Speciation
3. Sex determination – Sex linked inheritance, extra chromosomal Inheritance

Skill Outcomes:

On successful completion of the course, the students will be able to

1. Develop proficiency in cell counting and viability assessment techniques.
2. Observe and analyze mitosis and meiosis in onion root tips, understanding their stages and significance.
3. Identify and analyze the ultrastructure of cells through electron micrographs.
4. Recognize and interpret cancer cells through permanent slides or photographs.
5. Understand genetic concepts like linkage, recombination, gene mapping, DNA fingerprinting, and pedigree chart analysis

III SEMESTER
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credits -_1

1. Cell counting and Viability
2. Mitosis from onion root tips
3. Meiosis of onion root tips
4. Study of ultrastructure of cell (Plasma membrane, Nucleus, Nuclear Pore Complex, Chloroplast, Mitochondrion, Golgi bodies, Lysosomes, SER and RER)
5. Identification and study of types of cancer, cancer cells by permanent slides/ photographs.
6. Study of Linkage, recombination, gene mapping using marker-based data from *Drosophila*.
7. Demonstration of DNA fingerprinting.
8. Pedigree chart analysis.

III. References:

1. A.J.F Griffiths, S. R Wessler, S. B Carroll & J. Doebley, An Introduction to Genetic Analysis,. 10th Ed., W.H. Freeman & Company (New York) 2010
2. Geoffrey M. Cooper and Robert E. Hausman - The cell a molecular approach.