

Core III

Semester II

Cell Biology

Course Objectives:

- To understand the basic components of prokaryotic and eukaryotic cells and the role of various macromolecules in the cells.
- Understand how the formation of cytoskeleton
- To have an understanding on nucleic acids as the genetic material;
- To learn the basic mechanism of replication of nucleic acids
- Understand how cells undergo mitosis & meiosis

Course Outcomes

- Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles.
- Students will understand the components of cell wall & cytoskeleton
- Students will understand how these cellular components are used to generate and utilize energy in cells.
- Students will apply their knowledge of cell biology to selected examples of changes or losses in cell function. These can include responses to environmental or physiological changes.
- Students will understand the cellular components underlying mitotic and meiotic cell division.

Unit-I:

Learning Outcomes: Students will understand the origin, growth and basic components of cell, cell wall & cytoskeleton.

- The Cell: Cell as a unit of structure and function; Characteristics of prokaryotic and eukaryotic cells; Origin of eukaryotic cell (Endosymbiotic theory). Unique features of plant cells
- Plasmodesmata: Structure, role in movement of molecules & macromolecules, comparison with gap junctions.
- Plant Cell wall: Chemistry, structure and function.
- Cytoskeleton: The concept, structure and roles of microtubules, microfilaments and intermediary filament.

Unit-II:

Learning Outcomes: Students will recognize composition of Plasma Membrane and origin, structure, function of cell organelles

- Plasma Membrane: Overview of membrane structure and function; fluid mosaic model; Chemical composition of membranes; Membrane transport – Passive, active and facilitated transport, endocytosis and exocytosis.
- Cell organelles: Endoplasmic Reticulum, Golgi apparatus, Lysosomes & plant Vacuole.

Unit-III:

Learning Outcomes: Students will realize the importance of photosynthesis and cellular respiration

- Cell organelles: Chloroplast, Mitochondria and Peroxisomes: Structural organization & Function.
- Biogenesis & semiautonomous nature of mitochondria and chloroplast.
- Nucleus: Structure-nuclear envelope, nuclear pore complex, nuclear lamina & Function

Unit-IV:

Learning Outcomes: Students will understand the cellular units (DNA& RNA) underlying mitotic and meiotic cell division

- Nucleolus: Structure and function of nucleolus, Chromatin organization, its packaging role of nuclear matrix in chromosome organization and function, matrix binding proteins.
- Nucleic acids: Structure of nitrogenous bases; Structure and function of nucleotides; Types of nucleic acids; Structure of A, B, Z types of DNA; Types of RNA
- Cell division: Eukaryotic cell cycle, different stages of mitosis and meiosis. Cell cycle, Regulation of cell cycle.

Practical:

1. Study of plant cell structure with the help of epidermal peel mount of Onion/Rhoeo
2. Demonstration of the phenomenon of protoplasmic streaming in Hydrilla leaf.
3. Counting the cells per unit volume with the help of hemocytometer. (Yeast/pollen grains).
4. Study the phenomenon of plasmolysis and deplasmolysis.
5. Study of different stages of mitosis and meiosis using acetocarmine and acetoorceine method from Onion root tip and bud respectively.
6. To find out the mitotic index

Text Books:

- ✓ *Rastogi, V. B. (2016). Introductory Cytology, Kedar Nath & Ram Nath, Meerut*
- ✓ *Verma PS & Agarwal VK (2022) Cell Biology (Cytology, Biomoleculus and Molecular Biology) S Chand Publication ,New Delhi.*
- ✓ *Gupta, P. K. (2017). Biomolecules and Cell Biology, Rastogi Publication, Meerut.*
- ✓ *Kumar S. (2023). Cell biology, Pragati prakashan, Meerut*

Reference Books:

- ✓ *Sahoo, K. (2017) Biomolecules and Cell Biology, Kalyani Publishers, New Delhi.*
- ✓ *Tymoczko, J.L., Berg, J.M. and Stryer, L. (2012) Biochemistry: A short course, 2nd ed., W.H. Freeman*
- ✓ *Nelson, D.L. and Cox, M.M. (2008) Lehninger Principles of Biochemistry, 5th Edition, W.H. Freeman and Company.*
- ✓ *Cooper, G.M. and Hausman, R.E. 2009 The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.*
- ✓ *Kumar HD , Molecular Biology 2ed Vikas Publication*
- ✓ *Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009 The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco*