

**Course Name: Advanced Cell Biology**

**Course Number:** BY510

**Credit:** 3-0-0-3

**Prerequisites:** - IC 136 - Understanding Biotechnology & its Applications or  
Consent of Faculty member

**Students intended for:** B. Tech. 3<sup>rd</sup> and 4<sup>th</sup> year, MS/M. Tech., Ph.D.

**Elective or Core:** Core for M. Tech. Biotechnology, elective for others

**Semester:** Odd/Even

**Course objective:** Cells are the fundamental units of body and the major goal of this course is providing an introduction to the experimental methods that scientists have used to discover the mechanisms by which cells, at molecular level, control their specific functions, growth and differentiation into specialised tissues. Significant emphasis will be on the fundamentals of cell biology and to develop skill sets for reading and understanding scientific literature and to interpret experimental data.

**Course Outline:**

**Module 1 [8 lectures]**

**A tour to Cell:** Exploring Eukaryotic and plant cell; cell components, their structure and function; cytoskeleton network: components and structural functions; Cell-Cell and cell-matrix adhesion; Extracellular Matrix, Plant cell wall, Animal cell membrane; Cell junctions, plasmodesmata, gap junctions, desmosomes and tight junction

**Module 2 [8 lectures]**

**Membrane structure and function:** Membrane models; evolution of different membrane lipids, Membrane proteins and their functions, Membrane carbohydrates and their roles in cell-cell recognition; The permeability of the bi-layers: transport proteins; Passive, active and co transport by antiporters and symporters, transporter proteins in plant vacuoles exocytosis and endocytosis

**Module 3 [8 lectures]**

**Cell signalling and transport across cell membranes:** Signalling molecules and cell surface receptors; intracellular signal transduction; G protein coupled receptors; plant growth factors and hormones-auxins, gibberlines, cytokines and others passive and active transport; transport into prokaryotic cells; endocytosis, exocytosis; entry of viruses and toxins into cells

**Module 4 [8 lectures]**

**Membrane trafficking:** Translocation of secretory proteins across the ER membrane; protein modifications, folding and quality control in the ER; export and sorting of proteins to mitochondria, chloroplast and peroxisomes.

**Module 4 [10 lectures]**

**Eukaryotic cell cycle:** Biochemical and genetics studies on cell cycle; mechanisms regulating mitotic events; meiosis - a special type of cell division; Cell Birth, lineage and

death: Asymmetrical cell division, patterns of stem cell division; Biological description of apoptosis; Molecular basis of cancer, oncogenes and tumor suppressor genes

### **Text and reference books**

- Molecular Cell Biology, by Lodish et al (5th edition or recent), W.H. Freeman and Company, New York
- Molecular Biology of the Cell, by Alberts et al (4th edition or later), Garland Sciences, New York
- Lehninger Principles of Biochemistry (6th edition) by David L. Nelson, Michael M. Cox
- Biochemistry. L. Stryer W. H. Freeman & Company, New York (4<sup>th</sup> Edition)
- Additional material from recent scientific papers/reviews will be provided