

## Approved: 9<sup>th</sup> Senate Meeting

**Course Name:** Cell Physiology in Health and Diseases

**Course Number:** BY511

**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:

This course deals with the basic physiology of cells, with a particular emphasis on human and plant diseases. It will cover the following topics: cell and membrane structure and function; membrane channels and transporters and their roles in nutrient uptake, ion homeostasis, cell signaling and drug resistance; the electrical properties of membranes; the cellular and molecular basis of the excitability of the nervous system; excitation-contraction coupling in muscle; signal transduction; the molecular structure and function of membrane transport proteins; diseases involving transporter and channel defects. The course will emphasize on understanding the body's reaction in the production of signs and symptoms of the disorders of the immune system and diseases.

Learning Outcomes: On satisfying the requirements of this course, students will have the knowledge and skills to:

1. Describe the structure and function of membranes and explain how cells target the transport of proteins and other molecules within the cell
2. Explain the cellular and molecular basis of the excitability of the nervous system
3. Define the differences between channels and transporters and discuss in detail the role of these proteins in the uptake of nutrients and neurotransmitters, and in ion homeostasis and signalling
4. Understand the molecular basis of a range of diseases in which cell homing play a role

### Course Outline:

#### Module 1 [3 Lectures]

**Introduction to Cell Physiology:** Introduction to cell physiology, Cells of Eukaryotic system (animal), Cells of Eukaryotic system (Plant)

#### Module 2 [12 Lectures]

**Cell membrane physiology I:** Structure and organization of cell membrane and function, Membrane voltage-gated ion channels: molecular structure and regulation of

physiological process, Epilepsy and its biology, Alzheimer and its biology, Sickle cell anemia, Transport across biological membranes, Active/passive, diffusion, ion channels, aqua porins, Cystic fibrosis, polycystic kidney disease, Deafness, Liddle's syndrome.

### **Module 3 [7 Lectures]**

**Cell membrane physiology II:** Intra cellular compartments and cell Trafficking, vesicular trafficking, endocytosis and exocytosis, Protein Trafficking, Cell migration and homing, T cell homing.

### **Module 4 [14 Lectures]**

**Cell Adhesion:** Cell-to-cell signaling: hormones, receptors and intracellular messengers, Adhesion junctions, integrins, Cell adhesion and its role in immune cell maturation and activation, Adhesion and its role in bacterial/viral disease, Cancer initiation and progression, Extracellular matrix and cell-cell interactions.

### **Module 5 [6 Lectures]**

#### **Cell Respiration and Free radicals**

Cellular respiration, Generation of free radicals and their role in disease progression

#### **References and textbooks:**

- Cell Physiology Source Book: A Molecular Approach by Nicholas Sperelaki, 4<sup>th</sup> edition.
- Cellular Physiology by Mordecai P. Blaustein, Mordecai P. Blaustein, Kao Joseph P. Y., Donald R. Matteson 6<sup>th</sup> edition.
- Molecular Biology of the Cell by Bruce Alberts, Julian Lewis, Alexander Johnson, 6<sup>th</sup> edition.