



Course Number: BE 201

Course Name: Cell Biology

Credits: 3-0-2-4

Prerequisites: None

Intended for: B. Tech M.Tech Integrated Dual Degree Bioengineering students

Distribution: Core for Integrated Dual Degree Bioengineering students, elective for other B.Tech students

1. Preamble:

The objective of the course is to provide students with a comprehensive and concise overview of biological science and provide knowledge on the fundamentals of cell biology with emphases on its relationship with bio-engineering.

2. Course modules with Quantitative lecture hours:

Theory: [42 hours]

Module 1: Cells: The fundamental units of life [8 hours]

The structure and ultrastructure of the cell (the prokaryotic cell and the eukaryotic cell). Membrane enclosed Organelles (nucleus, chloroplast, mitochondria, ribosome etc) Model organisms (Yeast; simple eukaryotic cell, Arabidopsis; model plant, Fish/worms/mice; model animal)

Module 2: Cell Membranes and membrane transport [8 hours]

Membrane structure (lipid bilayer, and membrane protein), Passive and Active Transport, Ion channels, ATP pumps. Na^+ / K^+ / Ca^{2+} pumps uniport, symport antiporter system. Ligand gated / voltage gated channels, Agonists and Antagonists

Module 3: The cell-division cycle [8 hours]

Cell cycle – Mitosis, Meiosis, Molecules controlling cell cycle, Extra cellular matrix, role of

matrix in cell enthrone: Gap junctions, Tight junctions, Desmosomes, Hemidesmosomes

Module 4: Cell-cell communication and protein transport [8 hours]

General principles of cell signaling, G-protein couple receptor, enzymes-couple receptor, protein sorting, vesicular transport, endocytic pathways

Module 5: Techniques used to study cells [10 hours]

Cell fractionation, Morphology and identification of cells using microscopic studies like SEM, TEM and Confocal Microscopy. Localization of proteins in cells – Immunostaining.

Lab: [28 hours]



To demonstrate various techniques to learn the morphology, identification and propagation of cells

LIST OF EXPERIMENTS

1. Introduction to principles of sterile techniques and cell propagation
2. Principles of microscopy, phase contrast and fluorescent microscopy
3. Gram's Staining
4. Leishman Staining
5. Trypan Blue Assay
6. Staining for different stages of mitosis in *Allium Cepa* (Onion)

3. Text book:

- a. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter, "Molecular Biology of the Cell" - 6th Edition; Garland Science, 2014.

4. Reference books:

- a. Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Anthony Bretscher, Hidde Ploegh, Angelika Amon, Kelsey C. Martin, "Molecular Cell Biology" - 8th Edition W.H. Freeman, 2016.
- b. George Plopper, David Sharp, Eric Sikorski, "Lewin's Cells" – 3rd Edition –Johns & Bartlett Publishers, 2015
- c. Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, Jane B. Reece, "Campbell Biology"- 11th Edition, Pearson, 2020.

Indian
Institute of
Technology
Mandi