

MST102: CELL AND DEVELOPEMENTAL BIOLOGY

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives: The objectives of this course are to sensitize the students to the fact that as we go down the scale of magnitude from cells to organelles to molecules, the understanding of various biological processes becomes deeper and inclusive.

Unit I

CELL THEORY, MEMBRANE STRUCTURE AND FUNCTION: Evolution of life, The Diversity and Commonality of Cells, The Molecules of Cell, The Work of Cells, Investigating Cells and Their Parts.

BIOMEMBRANES AND CELL ARCHITECTURE: Bio membranes: Lipid Composition and Structural Organization, Bio membranes: Protein Components, and Basic Functions, Organelles of the Eukaryotic Cell, Purification of Cells and Their Parts, Visualizing Cell Architecture, Nucleus – Structure and function of nuclear envelope, lamina and nucleolus; Macromolecular trafficking; Chromatin organization and packaging

Unit II

INTEGRATING CELLS INTO TISSUES: Cell–Cell and Cell–Matrix Adhesion: An Overview, Sheet like Epithelial Tissues: Junctions and Adhesion Molecules, The Extracellular Matrix of Epithelial Sheets, The Extracellular Matrix of Nonepithelial Tissues, Adhesive Interactions and Nonepithelial Cells, Plant Tissues, Growth and Use of Cultured Cells, Microfilaments, Intermediately filaments and Microtubules

MEMBRANE TRANSPORT: ATP-Powered Pumps and the Intracellular Ionic Environment, Non-gated Ion Channels and the Resting Membrane Potential, Co-transport by Symporters and Antiporters, Movement of Water, Transepithelial Transport, Voltage-Gated Ion Channels and the Propagation of Action Potentials in Nerve Cells, Neurotransmitters and Receptor and Transport Proteins in Signal Transmission at Synapses

Unit III

CELL SIGNALING: Signaling Molecules and Cell-Surface Receptors, Intracellular Signal Transduction, G Protein–Coupled Receptors That Activate or Inhibit Adenylyl Cyclase, TGF-Receptors and the Direct Activation of Smads, MAP Kinase Pathways, Receptor Tyrosine Kinases and Activation of Ras, Cytokine Receptors and the JAK-STAT Pathway, Down-Modulation of Receptor Signaling, Experimental Approaches for Building a Comprehensive View of Signal-Induced Responses

MOVING PROTEINS INTO MEMBRANES AND ORGANELLES: Translocation of Secretory Proteins Across the ER Membrane, Insertion of Proteins into the ER Membrane, Protein Modifications, Folding, and Quality Control in the ER, Export of Bacterial Proteins, Sorting of Proteins to Mitochondria and Chloroplasts, Sorting of Peroxisomal Proteins

Unit IV

OVERVIEW OF THE CELL CYCLE AND ITS CONTROL: Biochemical Studies with Oocytes, Eggs, and Early Embryos, Genetic Studies with *S. pombe*, Molecular Mechanisms for Regulating Mitotic Events, Genetic Studies with *S. cerevisiae*, Cell-Cycle Control in Mammalian Cells, Checkpoints in Cell-Cycle Regulation, Meiosis: A Special Type of Cell Division, The Birth of Cells, Cell Death and Its Regulation, Cancer

Unit V

CELLULAR MOVEMENTS AND PATTERN FORMATION LAYING OF BODY AXIS PLANES; Differentiation of germ layers; Cellular polarity; Model plants like *Fucus* and *Volvox*; Maternal gene effects; Zygotic gene effects; Homeotic gene effects in *Drosophila*; Embryogenesis and early pattern formation in plants; Cell lineages and developmental control genes in *Caenorhabditis*.

Texts/References