B.Sc. III Year **Semester – V**

BBO-E501

DSE-1 Cell and Molecular Biology

MM : 100
Time : 3 hrs

Sessional : 30
ESE : 70
Pass Marks : 40

Learning objective:

- To understand the basic knowledge of cell and molecular biology, and techniques in molecular biology.
- To acquire information on cell and cell cycle, structure various cell organelles and their functions.
- To acquire an overall knowledge on cell membrane structure, functions and genetic material.
- To become familiar with transcription and regulation of gene expression.

Learning outcomes:

At the end of course student will be able

- The student will be able to familiar with various tools and techniques used in cell and molecular biology like Principles of microscopy like light microscopy, phase contrast microscopy; fluorescence microscopy; confocal microscopy etc.
- The student will be able to understand the electron microscopy like scanning EM and scanning Transmission EM (STEM); sample Preparation for electron microscopy; X-ray diffraction analysis.
- The student will be to understand the about the cell structure and functions, cell theory; prokaryotic and eukaryotic cells, various components of cells and their specific functions.
- The student will be able take the decisions for carrier point of views in research, industries and academia entrepreneurships etc.

Unit 1: Techniques in Biology: **(8 Lectures)**

Principles of microscopy; light microscopy; phase contrast microscopy; fluorescence microscopy; confocal microscopy; sample preparation for light microscopy; electron microscopy (EM)- scanning EM and scanning Transmission EM (STEM); sample Preparation for electron microscopy; X-ray diffraction analysis.

Unit 2:Cell and cell Cycle: **(8 Lectures)**

The cell theory; prokaryotic and eukaryotic cells; cell size and shape; eukaryotic cell components.Overview of cell cycle, mitosis and meiosis.

Unit 3: Cell Organelles: **(20 Lectures)**

Mitochondria: structure, marker enzymes, composition; semiautonomous nature; symbiont hypothesis; proteins synthesized within mitochondria; mitochondrial DNA. Chloroplast Structure, marker enzymes, composition; semiautonomous nature, chloroplast DNA. Endoplasmic reticulum, Golgi body &Lysosomes: structures and role. Peroxisomes and Glyoxisomes: structures, composition, functions in animals and plants and biogenesis. Nucleus: nuclear envelope- structure of nuclear pore complex; chromatin; molecular organization, DNA packaging in eukaryotes, euchromatin and heterochromatin, nucleolus and ribosome structure (brief).

Unit 4: Cell Membrane and Genetic Material: **(12 Lectures)**

Functions of membranes; models of membrane structure; the fluidity of membranes; membrane proteins and their functions; carbohydrates in the membrane; faces of the membranes; selective permeability of the membranes; cell wall .DNA: Miescher to Watson and Crick- historic perspective, Griffith's and Avery's transformation experiments, Hershey-Chase bacteriophage experiment, DNA structure, types of DNA, types of genetic material. DNA replication (prokaryotes and eukaryotes): bidirectional replication, semi-conservative.

Unit 5: Transcription and Regulation of Gene Expression: **(6 Lectures)**

Types of structures of RNA (mRNA, tRNA, rRNA), RNA polymerases; translation (prokaryotes and eukaryotes), genetic code. Prokaryotes: lac operon and tryptophan (trp) peron.

17.4.21

DSE-1 SEMESTER-V BBO-E551 (LAB COURSE-05)

1. To study prokaryotic cells (bacteria), viruses, eukaryotic cells with the help of light and electron micrographs.
2. Study of the photomicrographs of cell organelles
3. To study the structure of plant cell through temporary mounts.
4. Study of mitosis and meiosis (temporary mounts and permanent slides).
5. Study the effect of temperature, organic solvent on semi permeable membrane.
6. Demonstration of dialysis of starch and simple sugar.
7. Study of plasmolysis and deplasmolysis on *Rhoeo* leaf.
8. Measure the cell size (either length or breadth/diameter) by micrometry.
9. Study the structure of nuclear pore complex by photograph (from Gerald Karp)
10. Study of special chromosomes (Polytene&Lampbrush) either by slides or photographs.
11. Study DNA packaging by micrographs.
12. Preparation of the karyotype and ideogram from given photograph of somatic metaphase chromosome.

Suggested readings:

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. 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.
4. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., 2008 Molecular Biology of the Gene 6th edition. Cold Spring Harbour Lab. Press, Pearson Pub.
5. Dubey, R.C. A Text Book of Biotechnology. S. Chand & Company Pvt. Ltd. Ram Nagar, New Delhi-110 055.