

**JYOTI NIVAS COLLEGE AUTONOMOUS  
SYLLABUS FOR 2018 BATCH AND THEREAFTER**

**Programme: B.Sc.**

**Semester: I**

**BIOTECHNOLOGY PAPER I  
BIOMOLECULES AND CELL BIOLOGY**

**Course Code: 18IBT1**

**No. of Hours: 60**

**COURSE OBJECTIVES:**

- The objective of this course is to provide exposure to the students on cells, structural and functional UNIT of living organisms, and their intricate organization.
- The course helps the students to know the structure-function relationship of various biomolecules, and their importance with regard to maintenance and perpetuation of the cell.
- Provide a correlative aspect about cell cycle and cell signaling.

**LEARNING OUTCOMES:**

After successful completion of the course the students will be able to

- Comprehend the importance of chemical foundation and the overall architecture of prokaryotic and eukaryotic cells and their internal structures including organelles. in living organisms
- Assess the importance of various stages of cell cycle, and their regulation
- Explore of different types of biomolecules and the importance in cellular composition.
- Carry out a range of laboratory exercises, demonstrating the development of practical scientific skills.

**UNIT I WATER, CARBOHYDRATES AND LIPIDS**

**10 HRS**

**Introduction to chemical bonding, Water and its properties.**

**Carbohydrates:** Structure, classification & properties of carbohydrates – Monosaccharides (Glucose and fructose), disaccharides (maltose, lactose and sucrose), Polysaccharides (starch, glycogen and cellulose), Derived sugars (sugar alcohol, sugar acids, amino acids). **Lipids:** Structure and types of lipids (phospholipids, sphingolipids and steroids)

**UNIT II AMINO ACIDS, PROTEINS AND NUCLEIC ACIDS**

**14 HRS**

**Amino acids:** General structure. Classification of amino acids based on R groups. Properties of amino acids (isomerism, Zwitter ion concept and isoelectric point). **Proteins:** Peptide bond formation. Naturally occurring peptides, Classification of proteins [based on function and structure]. Factors stabilizing protein structure, Protein structural organization (primary, secondary, tertiary and quaternary structure).

**Nucleic acids:** Nitrogenous bases, Nucleosides and nucleotides, Watson and Crick model of DNA. Types of DNA [A, B and Z], Differences between DNA and RNA.

### **UNIT III STRUCTURE AND FUNCTION OF CELL AND ITS ORGANELLES 16HRS**

Introduction to cell. Cell theory, cell types, comparison of ultra-structure of prokaryotic cell (microbial) and eukaryotic (Plant and animal cells), cell wall and cell membrane (Fluid mosaic model), Sub cellular organelles (Isolation, organization and functions): Cytoskeleton (Microtubules, Intermediate filaments), Nucleus, Nucleolous Mitochondria, ER, Golgi Complex, Ribosome, Chloroplast, Peroxisomes, lysosomes and vacuoles. **Membrane transport** - Active, passive and bulk transport (Phagocytosis and pinocytosis).Introduction secretory pathway, transport pathway (ER- Golgi complex) and to mitochondria.

### **UNIT IV CHROMOSOMES**

**06 HRS**

Introduction to chromosomes, chromatin, structural organization of chromosome (Nucleosome model), *chromonema*, *Euchromatin* and *Heterochromatin*, *Centromere*, *Kinetochores* and *Telomere*. Giant chromosomes – Salivary gland and Lamp Brush chromosomes. A brief note on Karyotype and Idiogram.

### **UNIT V CELL SIGNALLING**

**06 HRS**

Introduction cell signalling, types of cell signalling (autocrine, paracrine, endocrine), receptors (cell surface and nuclear), secondary messengers (cAMP and Calcium ions), G protein coupled cell signalling (Example: Epinephrine)

### **UNIT VI CELL CYCLE**

**08 HRS**

Introduction to cell cycle – G<sub>1</sub>, S, G<sub>2</sub>, M and G<sub>0</sub> phases, Brief note on components of cell cycle control system, Overview of meristematic cell proliferation, cancer cells and its properties, cellular senescence, cell death (apoptosis and necrosis).

### **REFERENCES:**

1. Molecular Biology of Cell – Bruce Alberts *et al.*, **Publisher:** Garland Publications; 6<sup>th</sup> Edition (2014)
2. Cell Molecular Biology: Concepts and Experiments- Gerald Karp **Publisher:** John Wiley & Sons Inc; 7<sup>th</sup> Edition (2013).
3. The Cell, A Molecular approach by Geoffrey M. Cooper & Robert E. Hausman, 4<sup>th</sup> Ed, **Publisher:** Sinauer Associates, Sunderland (2007).
4. Cell & Molecular Biology – EDP Roberties & EMF Roberties. **Publisher:** Lea & Febiger; 8<sup>th</sup> Edition (1987).
5. Medical Cell Biology, Edited by Steven R. Goodman, Reprint, **Publisher:** J.B. Lippincott Company, Philadelphia (2007).
6. Cell Biology by C. B. Powar, Revised Edition, **Publisher:** Himalaya Publications. (1991).
7. Lehinger's principles of Biochemistry, Nelson and Cox., 7<sup>th</sup> edition, W. H. Freeman Publishers. (2017).
8. Biomolecules – Mohan P. Arora. Himalaya Publishing House, (2016).

**PRACTICALS – PAPER I: BIOMOLECULES& CELL BIOLOGY 15 UNITS**

1. Study of simple and compound microscope and types of cells [Bacteria, Fungus, Algae, Animal and Plant cells). 1UNIT
2. Micrometry - measurement of onion epidermal cell. 1UNIT
3. Study of Plasmolysis and Deplasmolysis in plant cell. 1UNIT
4. Cell division: Mitotic and Meiotic studies in plant cells. 3UNITS
5. Chromosomes: Mounting of Polytene chromosomes. 1UNIT
6. Staining of Buccal smear: Barr bodies. 1UNIT
7. Vital staining of Mitochondria. 1UNIT
8. Isolation of Chloroplast. 1UNIT
9. Qualitative tests for carbohydrate (Glucose, xylose, fructose Sucrose, Maltose and Starch) 2UNITS
10. Qualitative tests for amino acids (any two examples) and proteins (any one example) 2UNITS

Tests and Repetition.