Course Code	Course Name	Credits
26BY005	CELL AND MOLECULAR BIOLOGY	04

Course Objectives

- Build a clear understanding of how cells are structured, from simple prokaryotic cells to complex eukaryotic systems, and how each part contributes to life.
- Help students explore the nucleus as the control center of the cell, including how genetic material is organized and how cells grow and divide.
- Develop a strong foundation in nucleic acids, enabling students to understand how DNA and RNA store and transmit genetic information.
- Introduce students to the flow of genetic information (DNA → RNA → Protein) and how cells regulate this process in both simple and complex organisms.

Learning Outcomes

Upon successful completion of this course, it is intended that a student will be able to:

- Recognize and explain different cell structures and organelles and understand how they work together to support life.
- Describe the structure of the nucleus and chromosomes and clearly explain the stages of cell division with confidence.
- Understand and explain how genetic information is copied, expressed and maintained through processes like replication, transcription, and translation.
- Compare how gene expression is controlled in prokaryotes and eukaryotes, including operon systems and advanced regulatory mechanisms.

Unit 1 - Cell Structure (12 Hrs.)

Structural organization of Prokaryotic and Eukaryotic cells, Cell: Wall-primary and secondary, Plasma membrane, Endoplasmic Reticulum, Golgi complex, Mitochondria, Plastids, Ribosomes (70S and 80S).

Unit 2 – Nucleus (12 Hrs.)

Ultrastructure of Nucleus, Nucleoplasm and Nucleolus; Chromatin and its organization, Special types of chromosomes – Lamp brush chromosome and polytene chromosome; Overview of cell cycle, mitosis and meiosis.

Unit 3 – Nucleic acid (12 Hrs.)

Components and Organization of Nucleic acids; Structure and function of DNA- A, B and Z forms of DNA, Different forms of RNA and its function, Denaturation and Renaturation of DNA, DNA replication model and Proof for semi conservative model. Properties of DNA and RNA Polymerases.

Unit 4 – Gene expression (12 Hrs.)

Prokaryotic Transcription and Eukaryotic Transcription, Post Transcription modifications. Reverse transcription; Translation: Machinery, Formation of initiation complex, translocation, chain elongation and termination. Post Translation modifications.

Unit 5 – Regulation of Gene Expression (12 Hrs.)

Gene Organization in Prokaryotes and Eukaryotes, Operon concept- Lac and trp Operon, Positive and negative control, Repressor and Inducer; Eukaryotic gene regulation (Co-operative and on-off regulation)

Reference Books:

1. Alberts, Bruce, Bray, Dennis, Lewis, Julian, Raff, Martin, Roberts, Keith, & Watson, James D.. (2002). Molecular biology of the cell. New York, NY: Garland Publishing.
2. Verma, P. S., & Agarwal, V. K.. (1986). Cell biology and molecular biology (cytology). New Delhi, India: S. Chand & Company.
3. De Robertis, E. D. P., & De Robertis, E. M. F.. (1987). Cell and molecular biology (7th ed.). Philadelphia & Tokyo: Holt-Saunders International.
4. Lea, Peter J., & Leegood, Richard C.. (1999). Plant biochemistry and molecular biology. London, UK: John Wiley & Sons.
5. Old, R. W., & Primrose, S. B.. (1994). Principles of gene manipulation. London, UK: Blackwell Science.
6. Grierson, David, & Covey, Stephen N.. (1989). Plant molecular biology. New York, NY: Blackie Publishers.
7. Freifelder, David. (1998). Essentials of molecular biology (3rd ed.). New Delhi, India: Narosa Publishing House.
8. Verma, P. S., & Agarwal, V. K.. (2005). Cell biology, genetics, molecular biology, evolution & ecology. New Delhi, India: S. Chand & Co. Ltd.