Course Type	Course Code	Name of Course	L	Т	Р	Credit
DE	NCYD504	Introduction to Biomolecules and Bioprocesses	3	0	0	3

## **Course Objective**

- To understand the basic structure and function of biomolecules that are at the core of life.
- To understand the chemistry of the biomolecular processes that are required for sustaining life.
- To apply the principles of chemistry to manipulate the biological system.

## Learning Outcomes

- Basic knowledge of biomolecular structures and functions.
- How different biomolecules interact inside a living system.
- Preliminary understanding of how drugs are developed by targeting biomolecular interactions.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	<b>Title: Introduction to Chemistry of Life</b> Origin of life, basic architecture of a cell, physical and chemical properties of water, basic thermodynamics, and kinetics to understand cellular processes including enzyme kinetics, ligand binding, cooperativity etc.	5 L	Recapitulation of basic chemistry knowledge that will be important to follow this course.
2	<b>Title: Nucleosides, nucleotides, and nucleic acids</b> Introduction to nucleic acids: biological importance, discovery, and structure. Solution and solid phase synthesis of oligonucleotides. DNA Processing Enzymes: DNA polymerases, ligases, restriction endonucleases, PCR; enzymatic synthesis of nucleic acids; principle behind DNA sequencing; quadruplex nucleic acids; nucleic acids-based enzymes: ribozymes, DNA enzymes.	8 L	Basic understanding of DNA and its role in biology. Different molecular biology techniques and their utilization in analysis and manipulation of DNA.
3	<b>Title: Amino acids, peptides, and proteins</b> Amino acids: structure, acid-base chemistry, and chemical synthesis; peptide bond formation and coupling reagents-carbodiimides and phosphonium reagents; orthogonal protecting groups; solid-phase peptide synthesis: (Fmoc/Boc strategies); native peptide ligation; peptide sequencing; brief introduction to ribosomal protein synthesis; enzyme chemistry: protease and phosphatase; proteins as drug targets.	7 L	Basic understanding of proteins and its building blocks. Synthetic and natural approaches to peptides and proteins. Drug development using proteins as targets.
4	<b>Title: Carbohydrates and Lipids</b> Introduction to carbohydrates; structure, configuration and conformation; glycosylation: general concepts, glycoconjugates: glycolipids and glycoproteins; carbohydrates as informational molecule: the Sugar Code. Introduction to lipids: structure, function, and storage of lipids; different structural lipids in cell membrane, lipids as signals and cofactors, brief introduction to fatty acid metabolism.	7 L	Basic understanding of the structure and function of carbohydrates and lipids and their role in different cellular processes.
5	<b>Title: Glucose metabolism</b> Glycolysis and TCA pathways: important reactions and enzymes. Anaerobic glycolysis, regulation of glycolysis and the pentose phosphate pathway, glycogen synthesis and glycogen breakdown. Electron transport and oxidative phosphorylation.	8 L	Basic understanding of glucose catabolism and glucose storage as a source of energy.

	Title: Photosynthesis		Basic understanding of the	
6	Structure of the photosynthetic organelle, light and dark	7 L	photosynthetic pathway	
	reactions, the Calvin cycle, and the fate of Calvin cycle		including the role of light.	
	products.			

## **Textbooks:**

- 1. Fundamentals of Biochemistry: Life at the Molecular Level by Voet, Voet and Pratt. Wiley, 5<sup>th</sup> Edition 2016.
- 2. Lehninger Principles of Biochemistry by David L. Nelson & Michael M. Cox, W. H. Freeman; 6<sup>th</sup> edition 2013.
- 3. Biotechnology by David P. Clark and Nanette J. Pazdernik, Academic Cell Press, 2nd Edition 2015.
- 4. Bioinformatics: A Practical Approach. Shui Qing Ye; Chapman & Hall/CRC, 2008.
- 5. Pharmaceuticals Biotechnology Concepts and Applications, Gary Walsh, Wiley, 2013.