

# Structure and Functions of Biomolecules - Web course

## COURSE OUTLINE

The physiological activities in all the living organisms viz. movement, growth, respiration, digestion, excretion, respiration and response to stimuli are performed by the cells.

The Cell is basic unit of structure and function in living system.

The structural organization and functions of the cells are uniquely maintained by four major biomolecules namely carbohydrates, lipids, proteins and nucleic acids.

The course encompasses the study of cell, cell organelles, and deals with detail study of definition, classification, structure and cellular functions of its biomolecules carbohydrates, lipids, proteins and nucleic acids.

The overall perspective will be the biomolecules their characteristic properties and organization in carrying out all the living functions which constitute the life.

## COURSE DETAIL

Parts & Modules	Topics	Lectures
<b>Part I</b>	<b>Cell: Basic structure and functions</b>	
Module 1	Structural and biochemical organization of cell. Prokaryotic and Eukaryotic cells. Cell organelles, their molecular composition, structure and functions.	5
Module 2	Cell membrane and transport.	2
<b>Part II</b>	<b>Biomolecules</b>	
Module 3	Water- chemical properties, function as medium of cellular reactions and activities.	1
Module 4	<b>Carbohydrates</b> Definition, classification, stereo isomeric forms, structure, functions and reactions of biologically important carbohydrates viz. monosaccharide- glucose, fructose, mannose, galactose; Disaccharides – sucrose, lactose, maltose, cellobiose; structural and storage polysaccharides- starch, glycogen, inulin, hemicelluloses, cellulose, lignin, chitin and peptidoglycans.	6



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## Chemistry and Biochemistry

### Pre-requisites:

1. Basic understanding about cell and life processes.
2. Fundamentals of organic chemistry.
3. Preferably Biology and Chemistry as subjects at Undergraduate level.

### Additional Reading:

1. Molecular Biology of the Cell by [Alexander Johnson](#), [Julian Lewis](#), [Martin Raff](#), [Keith Roberts](#), [James D. Watson](#), 3<sup>rd</sup> Edition, Garland Taylor and Francis.
2. [The Lipid Handbook](#) by Frank D. Gunstone, John L. Harwood, and Albert J. Dijkstra, 3<sup>rd</sup> Edition, CRC Press.
3. Protein: Biotechnology and Biochemistry by Gary Walsh, Wiley.
4. Essentials of Carbohydrate Chemistry and Biochemistry By [Thisbe K. Lindhorst](#), Wiley-VCH.
5. Gene IX by Benjamin Lewin, Jones and Barlett Publishers.
6. Principles and Techniques of Practical Biochemistry by K. Wilson and J. Walker, 5<sup>th</sup> Ed, Cambridge University Press.
7. Biochemistry Laboratory: Modern Theory and Techniques by R.F. Boyer.

### Hyperlinks:

Some of the similar courses can be followed as:

1. [IBG :: Structure and function of biomolecules](http://www.ibg.uu.se/en/courses2/1BG351E/index.html)
2. [KJM5310 - Biomolecular Structure and Function](http://www.uio.no/studier/emner/matnat/kjemi/KJM5310/index-eng.xml)

### Coordinators:

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Module 5	<b>Amino acid, peptide and proteins</b> Essential and non-essential amino acids, amino acids building blocks of proteins, classification, structure and properties of amino acids, peptide bonds.	2
Module 6	Biologically important peptides, Protein-primary, secondary, tertiary and quaternary structures. Outline of various biological functions of proteins, Basic techniques in protein chemistry.	5
Module 7	<b>Lipids</b> Definition and nomenclature, Fatty acids and their types, structure and biological functions of various class of lipids – Triacyl glycerol, phospholipids, glycolipids, sphingolipids, terpenoid lipids, including steroids, alkyl glyceryl ethers and wax.	4
Module 8	<b>Nucleic acids</b> Nucleic acid as genetic material, building blocks of nucleic acids- purines and pyrimidines, nucleosides, nucleotides, DNA- double helix structure, properties and function, chromosomal organization; RNA- structure and functions of m-RNA, t-RNA and r-RNA.	5
<b>Part III</b>	<b>Regulation of Biomolecules</b>	
Module 9	<b>Concept of Gene, genome and gene expression</b> Central Dogma, and basic concept of Replication, transcription and translation, Concept of Gene and genome, Basic techniques in nucleic acids.	3
Module 10	<b>Enzymes</b> Enzymes as biocatalysts of cells classification of enzymes, Michaelis - Menten kinetics, enzyme assay and active site and mechanism of enzyme action, Inhibitors, allosteric enzymes.	4
Module 11	<b>Vitamins and Coenzymes</b> Structure and functions of thiamine, riboflavin, nicotinic acid, Pantothenic acid, pyridoxine, lipoic acid, Biotin, Folic acid, Ascorbic acid and Vitamin A.	3
<b>Total</b>		<b>40</b>

**References:**

1. Lehninger's Principles of Biochemistry by David L Nelson; A.L. Lehninger and Michael M. Cox, 5<sup>th</sup> edition, Worth Publishing.

2. Biochemistry by Lubert Stryer, John L Tymoczko, Jerry M. Berg, 5<sup>th</sup> edition, W.H. Freeman Company.
3. Biochemistry by Donald Voet and Judith G. Voet, 3<sup>rd</sup> edition, Wiley John and Sons.
4. Outline of Biochemistry by Eric.E. Conn and P.K. Stumpf, 5<sup>th</sup> edition, Wiley India.

