BIOMOLECULAR INTERACTIONS

Semester	Subject Code	Category	Lectu	re	Theory		Р	С
Ι	21CPBT1B	Core - II	5hrs per week	75	5 hrs per week	75	0	5

COURSE OBJECTIVES:

To understand the basics concepts and fundamentals of biochemistry with chemical bondings, bioenergetics, structure, function of biomolecules and its molecular interactions.

COURSE OUTCOMES	By the end of this course,	students will able to:
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CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL (K1-K6)
CO1	Describe the basic structure of atoms, principles of biochemistry, stabilizing interactions and the principle of pH.	K2
CO2	Identify and interpret the structure, functions and metabolism of carbohydrates and lipids.	K2
CO3	To understand and analyze the structure of proteins, amino acids and its metabolism.	K2, K4
CO4	To know about and understand the functions of nucleic acids, fat and water soluble vitamins.	K2
CO5	Understand and analyze various methods detecting biomolecular interactions	K2, K4

Knowledge level: K1- Remember; K2- Understand; K3- Apply; K4- Analyze; K5- Synthesize; K6- Evaluate

MAPPING WITH PROGRAMME OUTCOMES:

COS	PO1	PO2	PO3	PO4	PO5	PO6
C01	S	М	S	М	М	М
CO2	S	М	S	S	М	S
CO3	S	М	S	М	М	S
CO4	S	М	S	М	М	М
CO5	S	М	S	М	М	S

S-strong; M- medium; L-low

UNIT I:

Basic concepts of organic chemistry

Structure of atoms, molecules and chemical bonds. Covalent interactions: Covalent bond, Types of covalent bond – polar, non-polar, biological significance of covalent bond, covalent drugs. Non-covalent interactions - electrostatic, hydrogen bonding, Stabilizing interactions - Van der Waals, hydrophobic interactions, Significance of non-covalent interactions, non-covalent drugs.

pH, Henderson-Hasselbalch equation, Acid-base, Buffer, Role of buffers in biological system, phosphate buffer, bicarbonate buffer system, Reaction kinetics, Bioenergetics - Free energy, Entropy, Enthalpy, Laws of thermodynamics, High energy compounds, Colligative properties.

UNIT II

Carbohydrates and lipids

Carbohydrate, classification, stereo isomeric forms, mutarotation, D & L sugars, structure and functions 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. , Metabolism-glycogenesis, glycogenolysis, glycolysis HMP shunt.

Protein – carbohydrate interaction – N –linked (Type -1), O – linked (Type II0, O-linked (Type III). Protein – lipid interaction, function of lipoprotein.

Lipids: Classification, Structure and functions of lipids. Storage lipids (fatty acids, triglycerides), membrane lipids, glycerophopholipids, sphingolipids and steroids. Metabolism-beta-oxidation of fatty acids, biosynthesis of phospholipids

UNIT III Proteins

15 Hours

17 Hours

Amino acid: Classification, Essential and non-essential amino acids, amino acids building blocks of proteins, structure and properties of amino acids, peptide bonds.

Protein- Classification and properties of protein, Structure- primary, secondary, Ramachandran plot, tertiary and quatenarystructures. Transamination, Deamination and urea cycle.

Protein – Protein interaction – Protein interaction by Mass spectrometry, Protein affinity chromatography, affinity blotting, coimmunoprecipitation, Yeast Two – hybrid, Phage display.
UNIT IV

Nucleic acids and Vitamins

Nucleic acids:Nomenclature, Classification, DNA, RNA, Structure, Chemistry and properties of purines and pyrimidines, Nucleosides and Nucleotides. Biosynthesis and degradation of purines and pyrimidines.

5

12 Hours

18 Hours

Nucleic acid conjugate / protein– nucleic acid interaction – Electrostatic forces, Dipolar forces, Entropic forces, Dispersion forces. Single stranded nucleic acid binding proteins, Non-sequence –specific nucleases, Specific interactions, Restriction endonucleases – EcoRI and EcoRV. Zinc finger motif, leucine zipper, helix-turn-helix motif.

Vitamins: Fat soluble (A, D, E and K) and water soluble (B & C)- Chemistry, Function, Dietary sources and deficiency manifestation. Metabolism of fat and water-soluble vitamins.

UNIT V Methods for detection and analysis of biomolecule interactions 13 Hours

Spectroscopic methods – Mass Spectroscopy, UV-Visible spectroscopy, Circular Dichroism, Maldi-Tof, Surface Plasmon Resonance, Isothermal Titration Calorimetry, Differential Scanning Calorimetry, Thermal Shift Assay, Equilibrium dialysis, Affinity capillary electrophoresis.

Distribution of Marks: Theory 80% and Problems 20%

TEACHING METHODOLOGY:

- Class room teaching
- Assignments
- Discussions
- Homework
- PPT presentations
- Seminars
- Models and charts

TEXT BOOKS:

S.no.	Authors	Title	Publishers	Year of publication
1.	J.L. Jain	Fundamentals of Biochemistry	S. Chand & Company, Limited	2016
2.	A.C. Deb	Fundamentals of Biochemistry	New Central Book Agency (P) Ltd	2017
3.	G. Zubay	Biochemistry	Macmillan Publishing Co, New York	2010

REFERENCE BOOKS:

S.no.	Authors	Title	Publishers	Year of publication
1.	A.L. Lehninger., D.L Nelson and M.M. Cox	Principles of Biochemistry	Worth Publishers, New York	2016

2.	L. Stryer	Biochemistry	W.H. Freeman and Company	2018
3.	D. Voet& J.G. Voet	Biochemistry	Hoboken, N.J:J. Wiley & Sons	2016

WEB SOURCES:

- 1. https://proteopedia.org/wiki/index.php/Ramachandran_Plot
- 2. http://www.biologydiscussion.com/metabolism/carbohydrates
 - metabolism/metabolism-of-carbohydrates-10-cycles-with-diagram/11242
- 3. https://nptel.ac.in/courses/112105129/pdf/RAC%20Lecture%204.pdf
- 4. <u>http://ocw.ump.edu.my/pluginfile.php/9893/mod_resource/content/1/Nucleic%20Acid</u> %20Metabolism.pdf
- 5. <u>http://elearning.vtu.ac.in/moodle2/pluginfile.php/101/mod_folder/content/0/10BT43/</u> Biomolecular%20%20%20Interactions.pdf?forcedownload=1

Syllabus Designer:

• Dr. C. Suganthi Assistant Professor