



Course Title: Advanced Biochemistry
Course Code: GCMB603
Credit Units: 4

L	T	P/ S	Lab	TOTAL CREDIT UNITS
3			2	4

Course Objectives:

The course describes principles of bioenergetics and provides deeper insight into the structures, functions and properties of bio-molecules, regulation of biochemical pathways leading to synthesis and catabolism of bio-molecules.

Pre-requisites: Knowledge of biochemistry at graduate level.

Student Learning Outcomes:

- The students will have wide exposure of bio-molecular interactions and bioenergetics of biochemical pathways.
- The students will learn the structures, properties and functions of bio-molecules.
- The students will have knowledge of metabolic pathways leads to synthesis and catabolism of major bio-molecules.
- The students will gain knowledge of regulatory mechanisms underlying various metabolic pathways.

Course Contents/Syllabus- Theory:

	Weightage (%)
Module I Chemical basis of life and bioenergetics	10
Descriptors/Topics: composition of living matter, properties of water, properties of bio-molecules in aqueous environment, bio-molecular interactions. Bio-energetic principles, laws of thermodynamics, phosphate group transfers and ATP. Free energy of ATP and other phosphorylated substrates. Biological oxidation-reduction reactions. Components of metabolic pathways and redox balance points.	
Module II Carbohydrates Metabolism	20
Descriptors/Topics: Overview of structures and functions of carbohydrates. Regulation of biochemical pathways of carbohydrate metabolism: Glycolysis, Krebs's cycle, Acetyl-CoA from pyruvate, Phosphogluconate, Glyoxlate, and Pentose phosphate pathways. Cori cycle, Glycogenesis and glycogenolysis, gluconeogenesis and their roles in regulation of carbohydrate metabolism. Oxidative phosphorylation. Major metabolic disorders of carbohydrate metabolism ex. Diabetes	
Module III Amino acids and Proteins Metabolism	25
Descriptors/Topics: Overview of structures and functions of amino acid and proteins. Biosynthesis and regulation of aromatic (phenylalanine, tryptophan and tyrosine) and branched chain (valine, leucine and isoleucine) amino acids. Urea cycle, Porphyrin and heme metabolism, Succinate-glycine pathway, Major metabolic disorders of amino acid metabolism, Biological Nitrogen fixation,	

Structure and functions of vitamin derived coenzymes.	
Module IV Lipids Metabolism	20
Descriptors/Topics: Overview of structures and functions of lipids, derived lipids, glycerols, fatty acids, phospholipids, sphingolipids and lipoproteins. Biosynthesis and regulation of fatty acids in eukaryotes and prokaryotes. Structure and functions of fatty acid synthase. Oxidation of fatty acids, Cholesterol synthesis, Formation of ketone bodies, Integration of lipid, protein and carbohydrate metabolism.	
Module V Nucleic acid Metabolism	25
Descriptors/Topics: Overview of structures and functions of DNA and RNA. de-novo and salvage pathways of purine ribonucleotides synthesis and its regulation. Biosynthesis and regulation of pyrimidine ribonucleotides. Formation of deoxyribonucleotides from ribonucleotides catalyzed by ribonucleotide reductase. Degradation of Purine and pyrimidine nucleotides. Thymidylate synthetase as target enzyme for chemotherapy. Major metabolic disorders of nucleotide metabolism (Gout, Lesch-nuhan syndrome, immuno deficiency).	

Pedagogy for Course Delivery:

Lectures: 42
 Tutorial: 0
 Assignment/Presentation/ Seminar: 1
 Class Test: 2
 Total: 45

Lab/ Practical details, if applicable:

Practical: 28
 Class Test: 2
 Tutorials: 0
 Total: 30

List of Experiments:

- Preparation of molar, normal and % (w/v) solutions
- Preparation of buffers of different pH and molar strength
- Extraction and estimation of carbohydrates from given plant/animal materials
- Determination of total sugars by Anthrone method Separation of sugars by thin layer chromatography
- Extraction of total proteins; Estimation of proteins by Lowery/ Bradford Method
- Electrophoretic (SDS-PAGE) separation of isolated proteins
- Extraction of total lipids; estimation of phospholipids/glycolipids
- Thin layer chromatographic separation of lipids
- Extraction and estimation of DNA and RNA by UV-spectrophotometer

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	Total
75	25	100

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment						End Term Examination
Components (Drop down)	Class Test 1	Class Test 2	Home Assignment	Presentation/Seminar	Attendance	
Weightage (%)	5	10	5	5	5	70

Lab/ Practical/ Studio Assessment:

Components (Drop down)	Continuous Assessment/Internal Assessment				End Term Examination			Total
	Performance	Lab record	viva	Attendance	Lab record	Performance	Viva	
Weightage (%)	10	10	5	5	10	50	10	100

Text:

- Principles of Biochemistry, 4th Edition. Nelson, D.L. and M.M. Cox (2005). W.H. Freeman and Co. ISBN 9780716771081
- Fundamentals of Biochemistry: Life at the molecular level, 4th Edition. D. Voet, J.G. Voet and W. Pratt (2012). John Wiley & Sons Inc. ISBN 978-0-470-22842-5
- Introductory Practical Biochemistry. S.K. Sawney and R. Singh (2000). Narosa Publisher. ISBN 9788173193026
- An Introduction to Practical Biochemistry 3rd Edition. Plummer D.T. (1998). Tata McGrawhill Publication. ISBN: 1118357728

References:

- Principles of Biochemistry, 4th Edition. Robert Horton H, Laurence A Moran, Gray Scrimgeour K (2006). Pearsarson Publisher. ISBN-13: 978-0321707338.

Any other Study Material:

- Research Papers