



B.Sc. (Biochemistry) Sem. 4

Course Code	US04CBCH51	Title of the Course	Fundamental of Biomolecules & Minerals
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	<p>Student should be able to:</p> <ol style="list-style-type: none">1. Understand the structure and chemistry of the major classes of Biomolecules: proteins, amino acids and lipids2. Identify the mineral requirements.3. Describe the role of common minerals in normal physiology and disease.4. Review the beneficial effects of mineral supplements in the human body.
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Course Content		
Unit	Description	Weightage* (%)
1.	<p><i>AMINO ACIDS</i></p> <ul style="list-style-type: none">• Definition, general Structure, properties and structural classification of amino acids based on R groups. Uncommon or Non standard amino acids; D amino acids non-protein amino acids.• Classification of amino acids based on their metabolic fates; glycogenic and ketogenic amino acids.• Nutritional classification of amino acids: essential, semi essential and non essential amino acids with their examples.• Role of amino acids as building blocks of proteins and peptides. Other specialized functions of amino acids and their derivatives such as; precursors for hormones and neurotransmitters, skin pigment melanin etc.• Amino acids as zwitter ions, isoelectric point, pKa of amino acids, amino acid titration curve and optical activity of amino acids.• Reactions of amino acids due to carboxylic groups (decarboxylation and amide formation), amino groups (transamination, deamination, Schiff's base formation) and side chains.	25
2.	<p><i>PROTEINS</i></p> <ul style="list-style-type: none">• Definition, food sources of proteins. Various biological functions of proteins. Classification of proteins based on their	25





	<p>composition and solubility (Simple Proteins, Conjugated Proteins & Derived Proteins).</p> <ul style="list-style-type: none">• Nutritional classification of proteins (Complete proteins, partially incomplete Proteins, Incomplete Proteins)• Biological Important peptides; aspartate, glutathione, oxytocin, vasopressin, endorphins, sleep peptides, neuropeptides etc.• An overview of protein structure, peptide bond, primary, secondary, tertiary and quaternary structures of proteins.• Forces stabilizing the tertiary structure – Hydrophobic interactions, hydrogen bonds, ionic interactions, Vander Walls interactions and covalent cross linkages.• Protein Denaturation, coagulation and precipitations reactions of proteins.• Protein folding (brief)	
3.	<p><i>CHEMISTRY OF LIPIDS</i></p> <ul style="list-style-type: none">• Definition, properties, classification (Simple, compound, derived and miscellaneous lipids).• Functions and biological importance of different classes of lipids.• Fatty acids – free and esterified fatty acids, length of hydrocarbon chain, straight and branched chain fatty acids, hydroxyl and cyclic fatty acids, saturated and unsaturated fatty acids, nomenclature of fatty acids, omega classification of fatty acids.• Nutritional classification of fatty acids: essential fatty acids, examples, dietary sources and functions and deficiency of essential fatty acids.• Structure, properties and different biochemical tests for triglycerides (Saponification no, Iodine no, RM value, Peroxide value. Definition of rancidity, types of rancidity and prevention of rancidity of fats and oils. Triglycerides as storage lipids.• Lipids in biological membranes – Brief description of their structures and functions: glycerophospholipids, Sphingolipids, Glycolipids, Sulpholipids, and sterols.• Biological role and therapeutic applications of Eicosanoids, Prostaglandins and Leucotrienes.• Structure, composition and functions of different Lipoproteins: Chylomicrons, VLDL, LDL and HDL.	25
4.	<p><i>MINERALS</i></p>	25





	<ul style="list-style-type: none">• Definition, Classification of Minerals and trace elements.• Calcium, Phosphorus and Iron – Distribution in the body, absorption, Utilization and biochemical functions.• Transport, Excretion, Balance, Deficiency, Toxicity, Dietary Sources, RDA of Calcium, Phosphorus and Iron.• Trace elements: Iodine, Fluoride, Magnesium, Molybdenum, Copper, Zinc, Selenium, Cobalt, Chromium- Dietary sources, RDA, Distribution in the human body, Major Biochemical functions, and brief descriptions on their deficiency.• Role of different metal ions as enzyme cofactors.	
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Teaching-Learning Methodology	The course will be covered through lectures, with the help of new technologies. Apart from discussions on topics covered in lecture, assignment will also be given.
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Apply their knowledge of the fundamentals of various analytical methods to the study of biomolecules.
2.	Understand certain minerals are required in the body and that some minerals form essential structural components of tissues amino acid , protein and lipid
3.	Understand the structure ,classification and function of the above listed Biomolecules and minerals

Suggested References:





Sr. No.	References
1.	Biochemistry Mathews –Van Holde.
2.	Fundamentals of biochemistry Dr. J.L Jain, Dr.Sanjay Jain. Nitin Jain
3.	Textbook of biochemistry for medical students DM. Vasudevan, Sreekumari S. Kannan Vaidyanathan.
4.	Zubay's Principles of biochemistry VeerBala Rastogi K.R. Aneja.
5.	Textbook of Biochemistry for medical students RAFI MD.
6.	Biochemistry U.Satayanarayana, U Chakrapani.
7.	Outlines of Biochemistry Eric E. Conn, Paul k. Stumpf, George Bruening , Roy H. Doi
8.	Textbook of medical biochemistry Dinesh Puri.
9.	Textbook of medical biochemistry: 7th Edition – Rana Shinde, M.N. Chatterjea

On-line resources to be used if available as reference material

On-line Resources





B.Sc. (Biochemistry) Semester-4

Course Code	US04CBCH52	Title of the Course	CELL BIOLOGY
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	<p>Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles</p> <p>2. Students will understand how these cellular components are used to generate and utilize energy in cells</p> <p>3. Students will understand the cellular components underlying mitotic cell division.</p> <p>4. Students will apply their knowledge of cell biology to selected examples of changes or losses in cell function. These can include responses to environmental or physiological changes, or alterations of cell function brought about by mutation.</p> <p>5. the history of cytology and draw the structure of cell organelles and locate its parts along with functions</p>
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Course Content		
Unit	Description	Weightage* (%)
1.	<p>Cell & Cell organelles</p> <ol style="list-style-type: none">1. Introduction to cells2. Definition of cell, unicellular organism, multicellular organism, prokaryotic cells & Eukaryotic cells3. Difference between Plant Cell and Animal Cell.4. General features, Structure and Functions of following Organelles: -<ol style="list-style-type: none">a) Plasma membrane,b) Mitochondria,c) Golgi complex,d) Ribosome,e) Lysosomes,f) Peroxisome,g) ER (Endoplasmic Reticulum),h) Cytoplasm.	25
2.	<p>Cytoskeleton</p> <ol style="list-style-type: none">1. Introduction of Cytoskeleton2. Function of Cytoskeleton3. Types of Cytoskeleton4. Structure and Function of Actin filament5. Polymerization and De Polymerization of Actin filament	25





	<ol style="list-style-type: none"> 6. Structure and Function of Microtubule 7. Assembly and Dynamic instability and microtubule. 8. Location and Function of Centrosome 9. Chromosome segregation of Centrosome 10. Tread milling effect 11. Polymerization mechanism of intermediate filament 12. Structure and Function of Centrioles. 	
3.	Cell Cycle <ol style="list-style-type: none"> 1. Introduction of Cell Cycle 2. Importance of Cell Cycle 3. Phases of cell cycle 4. Molecular events during different phases of cell cycle. 5. Mitosis - different phases of Mitosis 6. Meiosis- different phases of Meiosis 7. Significance of Mitosis and Meiosis 8. Cell Cycle Regulation- Cyclin Dependent kinases 	25
4.	Apoptosis and Stem cell <ol style="list-style-type: none"> 1. Introduction of Apoptosis 2. Mechanism of Apoptosis <ol style="list-style-type: none"> a)The extrinsic pathway of Apoptosis b)The intrinsic pathway of Apoptosis 3. Significance of Apoptosis 4. Introduction of Stem cells 5. Types of Stem cells/ Classification of Stem cells 6. Application of Stem cells. 	25

Teaching-Learning Methodology	The course will be covered through lectures, with the help of new technologies. Apart from discussions on topics covered in lecture, assignment will also be given.
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%





Course Outcomes: Having completed this course, the learner will be able to

1.	Describe the evolution, diversity and replication of cells
2.	Explain the role of compartmentalization and signalling in cellular biology
3.	
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Suggested References:

Sr. No.	References
1.	The Cell- A molecular Approach Geoffrey and cooper.
2.	Cell Biology – C.b. Pawar Himalaya Publication.
3.	Cytology – varma and Agrawal.
4.	Cell and Molecular Biology –De Roberti's -8th edition.
5.	Cell and Molecular Biology John wiley and sons.
6.	Mol.biology and the cell-Albert.
7.	Plant Physiology by Salisbury & Ross.
8.	Plant Biochemistry by Hans-walter Heldt.

On-line resources to be used if available as reference material

On-line Resources





B.Sc. (Biochemistry) Semester-4

Course Code	US04CBCH53	Title of the Course	Biochemistry Practical
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	Student should be able to: 1. Students will explain/describe the synthesis of proteins, lipids. 2. Understand about the cell of plants and animals.
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Course Content		
Unit	Description	Weightage* (%)
1.	Study of color reactions and biochemical tests of amino acids and Proteins: Ninhydrin test, Biuret test, Xanthoproteic test, Millon's test, Hopkins-Cole test and Nitroprusside test.	
2.	Study of protein precipitation using diluted acid/alkali, higher salt concentration or using organic solvent.	
3.	Estimation of protein by Biuret method.	
4.	Qualitative analysis of Lipids: Solubility test, Iodine test for unsaturation, Saponification test for triglycerides, Liberman Buchard test/ Salkowski test for cholesterol.	
5.	Separation and Identification of amino acids by Paper Chromatography.	
6.	Estimation of fatty acid by titrametric analysis.	
7.	Study of compound microscope.	
8.	Vital staining of plant cell.	
9.	Vital staining of animal cell.	
10.	Study of different stages of mitosis using permanent slides.	
11.	Study of nucleus.	

Teaching-Learning Methodology	Topics will be taught and discussed in interactive sessions using conventional black board and chalk as well as ICT tools such as power point presentations and videos. Practical sessions will be conducted in a suitably equipped laboratory either individually or in groups depending on the nature of exercise as well as availability of infrastructure. Practical materials will be provided from primary and secondary sources of information.
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	students will be able to demonstrate an understanding of fundamental biochemical principles.
2.	They will gain the hands on knowledge of various techniques useful in biochemistry which can help them to stand with a skilful job at various industries and research labs

Suggested References:	
Sr. No.	References
1.	Standard methods of biochemical analysis –S.R.Thimmaiah
2.	Practical clinical biochemistry methods & interpretations – Ranjana Chawla
3.	Practical biochemistry by Harold Varley.

On-line resources to be used if available as reference material
On-line Resources
Related References Books

