



B. Sc. Biochemistry Semester-3

Course Code	US03MABIC01	Title of the Course	Biochemistry of Biomolecules
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	<ol style="list-style-type: none">1. To develop basic understanding of biomolecules like lipids and nucleic acids.2. To learn about basic understanding of enzymes, substrate, active site of enzyme3. To get aware about various classes of enzymes and mechanism of enzyme action.4. To get familiar with applications of enzymes in industry, diagnostic and as a therapy.
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Course Content		
Unit	Description	Weightage* (%)
1.	Carbohydrates <ul style="list-style-type: none">• Structure and importance of monosaccharide: Common monosaccharide (Triose, Tetrose, Pentose & Hexose sugars).• Aldose & Ketose sugars• Fischer & Haworth projection formulas• Structure of Glucose: Pyranose and furanose structures• Chiral Centre, Optical Isomerism, D& L isomers, Epimers, Anomers- Mutarotation• Properties & Reactions of Monosaccharides: Osazone formation, action of acids and alkali on sugars. Uronic acid derivatives of sugars, amino sugars and sugar phosphates.• Disaccharides and oligosaccharides: Reducing & NonReducing Disaccharides. Structure, Sources & Importance of disaccharides (Maltose, Sucrose and Lactose) as well as oligosaccharides (Raffinose, Stachyose and Verbascose)• Structure, Sources & Importance of polysaccharides: Starch, Glycogen, Cellulose, Hemi cellulose, Pectin and Heparin. Hyaluronic acid, Chondroitin Sulphate, Agar and Pectins	25%





2.	<p>Nucleic Acid</p> <ul style="list-style-type: none">• Introduction of nucleotides, nucleic acids (Types and structure in brief)• Importance of nucleotides• Organization of DNA in the cell. Denaturation & Renaturation of DNA strands, hyperchromicity, Melting temperature (T_m of DNA) and its significance.• Structure and functions of Different types of RNA: Messenger RNA (m-RNA), Transfer RNA (t-RNA), Ribosomal RNA (rRNA), small nuclear RNA (sn-RNA) and heterogeneous, nuclear RNA (hn-RNA)• Importance of 16S and 18S r-RNA in identification of species and their role in phylogenetic studies.• Definition of a gene, organization of genes in viruses, bacteria, animals and plants. Fine structure of the Gene: Cistron, muton and recon• Nucleosome structure and packaging of DNA into higher order structures, Genome• Basic concepts of genetic information: Nucleic acids as genetic information carriers, experimental evidences e.g. bacterial genetic transformation: Avery experiment, Hershey experiment, Stanley experiment, Central dogma of molecular biology and its modification.	25%
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3.	Enzymes <ul style="list-style-type: none">• Definition, historical perspective, general characteristics, apoenzyme, holoenzyme, co-factors – coenzymes and metal ions, and prosthetic group• Co-enzymes examples and functions• Classification and units of enzymes: Based on IUB with examples. Unit of enzyme activity – definition of IU, enzyme turn over number, Specific activity.• Properties of Enzyme: Catalytic activity of enzyme, enzyme specificity and regulation enzyme.• Enzyme specificity• Concept of active site and salient features of active site.• Mechanism of enzyme action: Fischer's lock and key hypothesis, Koshland's induced fit hypothesis, Substrate strain theory	25%
4.	Applications of Enzymes <ul style="list-style-type: none">• Use of enzyme to determine the concentration of metabolites of clinical importance fluids<ol style="list-style-type: none">a) Blood glucoseb) Uric acidc) Cholesterold) TG• Marker enzymes in diagnostics (SGPT, SGOT, creatine kinase, alkaline and acid phosphatases)• Enzyme therapy (Streptokinase), Cancer therapy• Industrial applications of enzymes) (Application of enzyme in Alcohol beverages, Breadmaking, Cheese making, Sweetness Clarification of beer's, Wines; Fruit juices & detergents)	25%





Teaching-Learning Methodology	Direct Teaching through Chalk-Walk and Talk ICT enabled teaching Question-Answer Class discussion led by teacher/students Case Studies Literature review Problem solving activities Debate Collaborative and Co-operative Learning Think Pair Share Jigsaw Inquiry Based Learning Panel Discussion Project Based Learning Flipped Classroom Blended Learning designs Concept Mapping
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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: On the successful completion of the course, the students will be able to understand

	By learning this course students will acquire knowledge of lipids and nucleic acids.
	Students will expand their knowledge regarding types of fatty acids and their significance.
	Students will gain a good understanding of types of nucleic acids, their chemical basis and significance.
	Students will get information about enzymes and its types.
	Students will achieve knowledge about use of enzymes in industry, therapy and as a diagnostic purpose.

Suggested References:

Sr. No.	References
1.	Lehninger Principles of Biochemistry by David L. Nelson, Michael Cox Publisher: WH Freeman
2.	Biochemistry by Donald Voet, Judith G. Voet Publisher: Wiley
3.	Biochemistry – By U Satyanarayana and U Chakrapani Publishers: Elsevier

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

On-line Resources:

https://onlinecourses.nptel.ac.in/noc22_cy06/preview

https://onlinecourses.nptel.ac.in/noc21_bt19/preview

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B. Sc. Biochemistry Semester-3

Course Code	US03MABIC02	Title of the Course	Essentials of Clinical Biochemistry-I
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	<ol style="list-style-type: none">1. To get knowledge related to circulatory system including structure of heart, cardiac cycle, etc.2. To get familiar with basic blood cells of human body and their significance.3. Explain what is meant by buffering. The chemical reactions occurring when a weak acid and its salt are added to an aqueous solution. To get knowledge of acid base imbalance.4. To get aware of different biophysical properties.
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Course Content		
Unit	Description	Weightage* (%)
1.	CIRCULATORY SYSTEM: <ul style="list-style-type: none">• Components of circulatory system• Functions of circulatory system• Circulatory routes-systemic & pulmonary circulatory system• Basic structure of human heart<ol style="list-style-type: none">a) Pericardiumb) Layers of heart wallc) Chambers of the heartd) Valves of the heart• Cardiac cycle	25%
2.	BLOOD CELLS <ul style="list-style-type: none">• Blood cells formation: Haematopoiesis• Erythrocytes(RBC) :-<ol style="list-style-type: none">a) Functions,b) physical characteristics/ Physiology,c) Erythropoiesisd) RBC life cycle (degradation of RBC)• WBC:- functions in detail• Platelets: functions, Platelet plug formation	25%





3.	ACID- BASE BALANCE AND IMBALANCE 1) Definition of Acid, Base, Buffer & pH 2) Buffers, buffer capacity and factors affecting buffering capacity 3) Physiological Buffer System & its importance a) Phosphate buffer system b) Bicarbonate buffer 4) Importance of pH balance in our body 5) Acid base imbalance a) Acidosis b) Alkalosis 6) Titration curve and pka of weak acid 7) H-H equation & its example to find pH and pka	25%
4.	BIOPHYSICAL BIOCHEMISTRY:- Colloid:- 1) Definition & Classification of Colloids 2) Properties of colloids (in short). a) Tyndal effect b) Dialysis c) Brownian movement d) Ageing e) Coagulation f) Electrical Properties 3) Biological significance of Colloids. 4) Definition & significance of following – a) Viscosity b) Surface tension c) Osmosis, Reverse osmosis and its use in water purifiers d) Diffusion e) Donnan membrane equilibrium	25%





Teaching-Learning Methodology	Direct Teaching through Chalk-Walk and Talk ICT enabled teaching Question-Answer Class discussion led by teacher/students Case Studies Literature review Problem solving activities Debate Collaborative and Co-operative Learning Think Pair Share Jigsaw Inquiry Based Learning Panel Discussion Project Based Learning Flipped Classroom Blended Learning designs Concept Mapping
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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: On the successful completion of the course, the students will be able to understand	
	circulatory system including structure of heart, cardiac cycle, etc.
	To get familiar with basic blood cells of human body and their significance.
	Explain what is meant by buffering. The chemical reactions occurring when a weak acid and its salt are added to an aqueous solution. To get knowledge of acid base imbalance.
	To get aware of different biophysical properties
	To get knowledge related to circulatory system including structure of heart, cardiac cycle, etc.





Suggested References:

Sr. No.	References
1.	Lehninger Principles of Biochemistry by David L. Nelson, Michael Cox Publisher: WH Freeman
2.	Biochemistry by Donald Voet, Judith G. Voet Publisher: Wiley
3.	Biochemistry – By U Satyanarayana and U Chakrapani Publishers: Elsevier
4.	Principles of Anatomy and Physiology- By Gerard J. Tortora, Bryan H. Derrickson Publishers: John Wiley & Sons, Inc.
5.	Human Physiology By Dr C C Chatterjee Publishers: Medical Allied Agency
6.	Molecular Biology of the Cell by Bruce Alberts et al, Publisher: Garland Science

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B. Sc. Biochemistry Semester-3

Major Biochemistry Practical

Course Code	US03MABIC03	Title of the Course	Biochemistry Practical
Total Credits of the Course	04	Hours per Week	08

Course Objectives:	<ol style="list-style-type: none">1. To develop understanding good laboratory practices in a biochemistry laboratory2. To learn how to work in a laboratory responsibly and safely.3. To understand the use of equipment for doing experiments and handling glassware.4. To study how to make standards and standard biochemical reagents.5. To gain the knowledge of identification of various biomolecules like carbohydrates and their quantitative estimation.6. To have understanding of estimation of enzymes.7. To have understanding of hemoglobin estimation, WBC, RBC and differential count.8. To have understanding of Iron estimation.9. To study how to make different buffer solutions.
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Sr No	Name of the Practical
SECTION-I	
1.	Laboratory safety rules and regulations
2.	Estimation of salivary amylase.
3.	Estimation of glucose by GOD-POD method
4.	Determination of Iodine value of oils.
5.	Estimation of reducing sugar by Cole's method.
6.	Osazone formation
7.	Qualitative analysis of Carbohydrate (Lactose)
8.	Qualitative analysis of Carbohydrate (Sucrose)
9.	Qualitative analysis of Carbohydrate (Maltose)





SECTION-II	
1.	Preparation of biochemical reagents <ul style="list-style-type: none">• Molar solution with examples• Normal solution with examples
2.	Estimation of hemoglobin by Drabkin's method
3.	WBC count by hemocytometer
4.	RBC count hemocytometer
5.	Estimation of Iron by Wong's method.
6.	Differential leukocyte count.
7.	Preparation of buffer solutions.
8.	Visit to diagnostic laboratory and blood bank

Teaching-Learning Methodology	Direct Teaching through Chalk-Walk and Talk ICT enabled teaching Question-Answer Class discussion led by teacher/students Case Studies Literature review Problem solving activities Debate Collaborative and Co-operative Learning Think Pair Share Jigsaw Inquiry Based Learning Panel Discussion Project Based Learning Flipped Classroom Blended Learning designs Concept Mapping
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Course Outcomes: On the successful completion of the course, the students will be able to understand

By learning this course students will acquire knowledge of lab safety rules and regulations

Students will gain a good understanding of preparation of various reagents and lab instruments.

Students will learn about qualitative analysis of carbohydrates and measuring the concentration of biomolecules.

Students will understand the estimation of enzymes

Students will able to determine the blood glucose concentration by enzymatic method.

Students will earn hemoglobin estimation, WBC, RBC and differential count.

Students will have understanding of Iron estimation.





Suggested References:

Sr. No.	References
1.	Standard Methods of Biochemical Analysis S.K. Thimmaiah Publishers: Kalyani
2.	Principles & Techniques of Practical Biochemistry – Wilson, Walker- Cambridge Univ. Press.
3.	An Introduction to Practical Biochemistry by David T. Plummer
4.	Textbook of Medical Laboratory Technology by Praful B. Godkar; Darshan P. Godkar

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B. Sc. Biochemistry Semester-3

Interdisciplinary/Multidisciplinary Paper

Course Code	US03IDBIC01/US03MDBIC01	Title of the Course	Fundamentals of Biomolecules
Total Credits of the Course	02	Hours per Week	02

Course Objectives:	<ol style="list-style-type: none">1. To learn the fundamentals of molecules that deals with life such as nucleic acids and Lipids.2. To develop understanding of structure, types and significance of nucleic acids.3. To learn classification of various types of lipids and their biological role.4. To study the genetic basis of life by having knowledge of nucleic acids such as DNA and RNA.
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Course Content		
Unit	Description	Weightage* (%)
1.	BIOCHEMISTRY OF LIPIDS <ul style="list-style-type: none">• Definition and functions of lipids• Classification of lipids: Simple, Compound, Derived, miscellaneous and natural lipids.• Fatty acids: Saturated and Unsaturated, Essential and non-essential fatty acids• Nomenclature of fatty acids• Dietary sources and functions of fatty acids	50%
2.	NUCLEOTIDES AND NUCLEIC ACIDS <p>Purine and Pyrimidine bases, Structure and nomenclature of nucleosides and nucleotides, Ribose and deoxyribose sugars, Phosphodiester bond Chargaff's Rule Structure of DNA double helix (Watson and crick model) Structure and functions of Different types of RNA:</p> <ul style="list-style-type: none">• Messenger RNA (m-RNA)• Transfer RNA (t-RNA)• Ribosomal RNA (r-RNA) <p>Functions of nucleic acids</p>	50%





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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: On the successful completion of the course, the students will be able to understand	
	By learning this course students will acquire knowledge of functions of lipids and nucleic acids.
	Students will gain a good understanding of types of lipids and nucleic acids, their chemical basis and structure.





Suggested References:

Sr. No.	References
1.	Lehninger Principles of Biochemistry by David L. Nelson, Michael Cox Publisher: WH Freeman
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B. Sc. Biochemistry Semester-3

Course Code	US03IDBIC02/US03MDBIC02	Title of the Course	Biochemistry Practical
Total Credits of the Course	02	Hours per Week	04

Course Objectives:	<ol style="list-style-type: none">1. To study identification of lipids.2. To have understanding of quantification of lipids and nucleic acids.3. To learn the determination of acid value and saponification value.4. To gain knowledge of normality of acids and bases.
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Sr No	Name of the Practical
1.	Qualitative analysis of lipid
2.	To find out free fatty acid value of an oil
3.	To find out saponification value of an oil
4.	Estimation of DNA by DPA method
5.	Estimation of RNA by orcinol method
6.	Normality of Acid
7.	Normality of Base

Teaching-Learning Methodology	Direct Teaching through Chalk-Walk and Talk ICT enabled teaching Question-Answer Class discussion led by teacher/students Case Studies Literature review Problem solving activities Debate
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	Collaborative and Co-operative Learning Think Pair Share Jigsaw Inquiry Based Learning Panel Discussion Project Based Learning Flipped Classroom Blended Learning designs Concept Mapping
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Course Outcomes: On the successful completion of the course, the students will be able to understand

By learning this course students will acquire knowledge of quantitative estimation of lipids and nucleic acids

Students will gain a good understanding of acid value and saponification value of lipids

Students will learn about qualitative analysis of lipids.





Suggested References:

Sr. No.	References
1.	Standard Methods of Biochemical Analysis S.K. Thimmaiah Publishers: Kalyani
2.	Principles & Techniques of Practical Biochemistry – Wilson, Walker- Cambridge Univ. Press.
3.	An Introduction to Practical Biochemistry by David T. Plummer

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B. Sc. Biochemistry Semester-3

Skill Enhancement Course (SEC)

Course Code	US03SEBIC01	Title of the Course	Tools and Techniques in Biochemistry-III
Total Credits of the Course	02	Hours per Week	02

Course Objectives:	1) Students will gain a good understanding of common laboratory instruments available in a biochemistry laboratory.
	2) By learning this course students will acquire knowledge of Colorimeter and Spectrophotometer
	3) To get knowledge of centrifuge techniques

Course Content		
Unit	Description	Weightage* (%)
1.	Centrifugation Techniques <ol style="list-style-type: none">1. Introduction of Centrifuge2. General Principle and derivation for G and RCF3. Types of centrifuge4. Ultracentrifuge<ol style="list-style-type: none">A. analyticalB. preparative centrifuge;5. Types of rotors: vertical, fixed angle, swinging bucket6. Importance of centrifuge	50%
2.	Colorimeter and Spectrophotometer <ol style="list-style-type: none">1. Beer Lambert's law and derivation2. Definition for Transmittance, Absorbance, Optical density, λ max3. Principle, flow diagram, working & applications of<ol style="list-style-type: none">A. ColorimetersB. UV-Visible spectrometers	50%





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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)	25%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	25%
3.	University Examination	50%

Course Outcomes: On the successful completion of the course, the students will be able to understand	
	By learning this course students will acquire knowledge of Colorimeter and Spectrophotometer
	Students will gain a good understanding of common laboratory instruments available in a biochemistry laboratory.





Suggested References:

Sr. No.	References
1.	Principles and techniques of biochemistry & molecular biology. Wilson and Walker. Andreas Hofmann and Samuel clokie
2.	Principles & Techniques of Practical Biochemistry – Wilson, Walker- Cambridge Univ. Press.
3.	Biophysical chemistry- Principles and techniques- Upadhyay, Upadyay and Nath Himalaya Publication house Mumbai.

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