



B.Sc. (Biochemistry) Sem. 5

Course Code	US05CBCH51	Title of the Course	Molecular Biology
Total Credits of the Course	4	Hours per Week	4
Course Objectives:	Student should be able to: 1. Understand the concepts of Molecular Biology and Genetics 2. Understand the concepts of Gene, Chromosome, Nucleosomes Chromatin and Genome 3. Understand Salient features of viral genome, Prokaryotic genome, Eukaryotic genome. 4. Understand the information of replication, transcription, Translation 5. Understand the Importance of Reverse transcription. 6. Understand the Importance of Inhibition of protein synthesis.		

Course Content		
Unit	Description	Weightage* (%)
1.	Basic Concept of Molecular Biology 1) Introduction of Molecular Biology and Genetics 2) Definition of Gene, Chromosome, Chromatin and Genome 3) Concept of Gene 4) Concept of Chromosome and Chromatin 5) Histones are small basic Protein 6) Nucleosomes 7) Salient features of Viral genome, 8) Salient features of Prokaryotic genome 9) Salient features of Eukaryotic genome.	25
2.	DNA Replication 1) Introduction of Replication 2) Definition of Replication, Replisome and Primosome 3) Set of fundamental rules for DNA replication A. DNA replication is semi conservative B. Replication begins at an origin and usually proceeds bidirectionally C. DNA synthesis proceeds in 5' to 3' direction and is semi discontinuous 4) Prokaryotic DNA polymerases: Activities of DNA polymerase I, II and III. 5) Mechanism of replication: A. Initiation, B. Elongation C. Termination. 6) Differences in Prokaryotic and Eukaryotic Replications	25



3.	Transcription 1) RNA polymerases in Prokaryotic and Eukaryotic organisms 2) Promoters in Prokaryotic and Eukaryotic organism 3) Mechanism of transcription: A. Initiation B. Elongation C. Termination. 4) Post transcriptional modification A. Splicing mechanism of group 1,2,3,4 B. Generation of 5' cap in m RNA C. 3' poly a tail formation in mRNA 5) Reverse transcriptase and Reverse transcription	25
4.	Translation / protein synthesis 1) Genetic code: Definition and properties of genetic code 2) Role of ribosomes, m RNA and t RNA in Translation 3) Mechanism of Translation A. formation of fmet tRNA fmet B. Activation of amino acid C. Initiation D. Elongation E. Termination 4) Post translational modification 5) Inhibition of protein synthesis by antibiotics and toxins.	25

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, Course 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.	Understand the concepts of Molecular Biology and Genetics
2.	Recognize vocabulary used in biochemistry especially in relation to proteins, DNA, enzymes, etc.
3.	Applying vocabulary and basic concepts to solving more advance problems in biochemistry.
4.	Understand that the correct concepts of gene and genome are essential for normal functioning of the body

Suggested References:

Sr. No.	References
1.	Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., 2008 Molecular Biology of the Gene
2.	Freifelder's Essentials of Molecular Biology by George M. Malacinski
3.	Nelson and Cox, Lehninger's Principles of Biochemistry (2000), Worth Publish., Inc. NewYork.

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

On-line Resources

Related References Books



B.Sc. (Biochemistry) Sem. 5

Course Code	US05CBCH52	Title of the Course	Enzymology
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	<ol style="list-style-type: none">1. The students will gain the knowledge of various types of enzymes2. The theories of enzyme kinetics, the mechanisms of enzyme catalysis, and the mechanisms of enzyme regulation in the cell.3. Use of enzymes in biotechnology and bioanalytics including biosensors and enzyme reactors
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Course Content		
Unit	Description	Weightage* (%)
1.	Basic concept of Enzymology <ol style="list-style-type: none">1) Introduction and Definition of enzyme, Coenzyme with examples, Apoenzyme, Holoenzyme, Co-factors, activators, inhibitors, abzyme, Ribozyme, Metalloenzyme, Unit activity of enzyme, Turn over number (K_{cat})2) Nomenclature and classification based on IUB with examples and EC number.3) Properties of enzymes: catalytic activity, regulation, enzyme specificity4) Salient feature of active site5) Mechanism of Enzyme Action<ol style="list-style-type: none">a) Lock & Key Modelb) Induced Fit Theoryc) Substrate strain theory	25%
2.	Isolation and purification of enzymes <ol style="list-style-type: none">1) Introduction, objectives & Strategy of enzyme Purification.2) In brief methods that based on size / mass (Principle/Application)<ol style="list-style-type: none">a) Centrifugationb) Gel filtrationc) Ultra filtration & dialysis3) Methods based on polarity<ol style="list-style-type: none">a) Ion exchange chromatographyb) Electrophoresis4) Methods that based on change in solubility<ol style="list-style-type: none">a) Change in pHb) Change in ionic strengthc) Decrease in dielectric constant5) Methods based on the possession of specific binding sites or structural features<ol style="list-style-type: none">a) Affinity Chromatographyb) Affinity Elution	25%



3.	Enzyme kinetics & Inhibition <ol style="list-style-type: none">1) Relationship between initial velocity and substrate concentration2) Michaelis -Menten Equation & plot3) Lineweaver – Burk(L-B)Equation & plot4) Significance of Km and Vmax5) Factors affecting enzyme activity:<ul style="list-style-type: none">Effect of enzyme concentrationEffect of Substrate concentrationEffect of pHEffect of temperatureEffect of product concentrationEffect of light & radiation6) Allosteric enzymes, Kinetics and regulation7) Enzyme Inhibitions<ol style="list-style-type: none">a) Reversible Inhibitions<ol style="list-style-type: none">a) competitive inhibitionb) non-competitive inhibitionc) uncompetitive inhibitionb) Irreversible inhibition<ol style="list-style-type: none">a) Suicide Inhibitionb) Feed Back inhibition8) Bisubstrate reaction<ol style="list-style-type: none">a) Sequential mechanismb) Non-sequential mechanism	25%
4.	Applied Enzymology/ Enzyme Technology/ Clinical & Industrial Application of Enzyme <ol style="list-style-type: none">1) Diagnostic utility & medical applications of enzyme , Isoenzymes; Creatine Kinases & Lactate Dehydrogenases, SGPT and SGOT2) 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.3) Use of glucose oxidase in enzyme electrodes.4) Enzyme therapy:<ol style="list-style-type: none">a) in treatment of genetics deficiency diseaseb) cancer therapy5) Industrial application of enzyme Application of enzyme in Alcohol beverages, Breadmaking, Cheese making, Sweetness Clarification of beer's, Wines & Fruit juices & detergents6) Immobilization of enzyme & its industrial application	25%

Teaching-Learning Methodology	This course will be taught by a mixture of discussion, lecture, readings, smart - board technology, on-line quizzes and student presentation modalities.
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Vallabh Vidyanagar, Gujarat
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Syllabus with effect from the Academic Year 2023-2024

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.	Student will learn about structure and function of enzymes, principles of enzyme catalysis and applications of enzymes in research and industry.
2.	Use the equations of enzyme kinetics.
3.	Applications of enzymes in various industries.
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Suggested References:	
Sr. No.	References
1.	Understanding Enzymes by Trevor Palmer
2.	Fundamentals of Enzymologist : Nicholes C. Price and Lewis Stevens, Oxford Univ. Press.
3.	Enzymes: M. Dixon, E. C. Webb, CJR Thorne and K. F. Tipton, Longmans, London
4.	L. Stryer BIOCHEMISTRY W.H. Freeman Co., San Francisco, USA

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



B.Sc. (Biochemistry) Sem. 5

Course Code	US05CBCH53	Title of the Course	Human Metabolism-I
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	<ol style="list-style-type: none">1. To understand major catabolic and anabolic pathways in metabolism of carbohydrates and lipids2. To recall the key regulatory points in metabolic pathways3. To explain how diet and hormonal signalling regulate metabolic pathways4. To learn molecular mechanisms underlying major inherited diseases of metabolism5. To connect specific symptoms in clinical case presentations to metabolic disorders <p>...</p>
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Course Content		
Unit	Description	Weightage* (%)
1.	CARBOHYDRATE METABOLISM <ul style="list-style-type: none">• Basic concept: Anabolism, Catabolism• Digestion and absorption of carbohydrate (In brief)• The entry of glucose into cells: Sodium-Glucose symport, Uptake by glucose transporter• Glycolysis: Energetics of glycolysis, Regulation of glycolysis, Inhibitors of glycolysis, Conversion of pyruvate to lactate, feeder pathways for glycolysis• Rapaport - Leubering Cycle• Gluconeogenesis and its regulation• Hexose monophosphate shunt and significance• Glucose-alanine cycle and Cori cycle• Krebs cycle: Energetics of Krebs cycle, Regulation of Krebs cycle• Synthesis of carbohydrates (In Brief): C3, C4 and CAM	25%
2.	CARBOHYDRATE METABOLISM AND ASSOCIATED DISORDERS <ul style="list-style-type: none">• Hormonal regulation of Carbohydrate metabolism (role of Insulin & Glucagon)• Glycogen metabolism : Role of glycogen, Glycogenesis & Glycogenolysis along with regulation• Glycogen storage diseases (Type 0, Type I – VII)• Glycosuria, Pentosuria, Fructosuria• Diabetes mellitus (Classification, Clinical and Biochemical Symptoms)	25%



3.	LIPID METABOLISM Fatty acid oxidation <ul style="list-style-type: none">• Digestion, absorption and transport of lipid in blood,• Alpha, beta and omega Oxidation of Saturated Fatty acid• Oxidation Unsaturated, and Odd carbon chain of fatty acids• Degradation of phospholipids and glycolipids• Oxidation of Ketone Bodies• Metabolism of lipoproteins; Structure, Types, Chemistry and importance	25%
4.	LIPID METABOLISM AND ASSOCIATED DISORDERS Fatty acid biosynthesis <ul style="list-style-type: none">• Biosynthesis of Fatty acids, TG, Cholesterol• Synthesis of Ketone bodies• Synthesis of glycolipids and phospholipids• Hormonal regulation of lipid metabolism• Diseases associated with lipid metabolism(In Brief); Hypercholesterolemia, Atherosclerosis and Fatty Liver	
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Teaching-Learning Methodology	This course will be taught by a mixture of discussion, lecture, readings, smart-board technology, on-line quizzes and student presentation modalities.
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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.	The focus is on the regulation of sugar and fat metabolism in eukaryotes, with an emphasis on mammals. The course will begin with a review of carbohydrate and lipid metabolic pathways, particularly pathway integration and regulation.
2.	The physiology of the carbohydrate Digestion in mammals
3.	Illustrate the metabolism of carbohydrates through various anabolic and catabolic pathways like glycolysis, Kreb's cycle, Glycogen metabolism, glucuronic acid cycle and others.
4.	Development of understanding about the disorders due to enzyme which works in metabolism process.

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.	Textbook of biochemistry by Rafi MD Publisher: Universities Press (India) Pvt. Ltd.
4.	Biochemistry – By U Satyanarayana and U Chakrapani Publishers: Elsevier
5.	Biochemistry by Jeremy M. Berg (Editor), John L. Tymoczko (Editor), Lubert Stryer (Editor)

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

On-line Resources



B.Sc. (Biochemistry) Sem. 5

Course Code	US05CBCH54	Title of the Course	Human Physiology
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	<p>1. This course covers the physiology of humans with emphasis on the major organs and the processes they govern, including Muscle function and movement; Respiratory system; Digestive system and absorption of Biomolecules; Circulatory system and Cardiac cycle; Nervous system and nerve impulse transmission; Urinary system and osmoregulation</p> <p>2. Terminology, basic chemistry, structural organisation, cell organelles structure and function, tissue, and the overview of all human body systems.</p>
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Course Content		
Unit	Description	Weightage* (%)
1.	<p>INTRODUCTION TO PHYSIOLOGY</p> <ul style="list-style-type: none">• Definition of anatomy & physiology• Level of structural organisation• Cell organelles and their functions• Types of four basic tissues• All systems of human body: Components & their general functions <p>Homeostasis: Homeostasis, Control of homeostasis: Negative and positive feedback system, Homeostatic imbalance</p> <p>Muscular system Types of muscles, biochemical composition of skeletal muscles, Mechanism of muscle contraction</p>	25%
2.	<p>RESPIRATORY SYSTEM</p> <p>Definitions: respiration, internal, external Components of upper respiratory & lower respiratory system with general functions. Functions of respiratory system Phases of respiration Transport of oxygen and carbon dioxide Factors affecting the affinity of Hb for oxygen (I) Acidity (pH) (II) Partial pressure of Co₂ (III) Temperature (IV) BPG Definition and types of Hypoxia.</p>	25%



3.	<p>DIGESTIVE SYSTEM AND CIRCULATORY SYSTEM</p> <p>DIGESTIVE SYSTEM: Components of digestive system and their functions Digestion and absorption of carbohydrate, protein and lipid</p> <p>CIRCULATORY SYSTEM: Components and functions of circulatory system Circulatory routes-systemic & pulmonary circulatory system Basic structure of human heart Cardiac cycle</p>	25%
4.	<p>NERVOUS & URINARY SYSTEMS</p> <p>NERVOUS SYSTEMS: Organization of the Nervous System (central & peripheral nervous system) Functions of the Nervous System. Basic Structure of neuron Nerve impulse transmission (electrical and chemical)</p> <p>URINARY SYSTEMS Functions of the kidney Basic structure of urinary system & kidney Structure of nephron, types of nephron. Urine formation (Glomerular filtration, tubular reabsorption and secretion)</p> <ul style="list-style-type: none"> • GFR • Renal threshold • Tubular load • Tubular maxima value (Tmax) • Plasma clearance 	25%
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Teaching-Learning Methodology	The teaching methodology consists of lectures, discussion, new technologies.
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Evaluation Pattern		
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3.	University Examination	70%
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Course Outcomes: Having completed this course, the learner will be able to know

1.	The structure of major human organs and explain their role in the maintenance of healthy individuals.
2.	Importance of homeostasis in human body.
3.	The activities of organs are integrated for maximum efficiency.
4.	The functional relationships between various organ systems of the body.
5.	The anatomy and physiology of cardiovascular and respiratory system.
6.	The anatomy and physiology of digestive, nervous and urinary system.

Suggested References:

Sr. No.	References
1.	Principles of Anatomy and Physiology- Gerard .J. Tortora and Bryn Derrickson
2.	Textbook of Medical Physiology- Arthur. C .Guyton, John. E .Hall
3.	Medical Physiology- Vol.1 and Vol.2-C.C.chatterjee
4.	Biochemistry - Satyanarayan



B.Sc. (Biochemistry) Sem. 5

Course Code	US05CBCH55	Title of the Course	Biochemistry Practical
Total Credits of the Course	8	Hours per Week	12

Course Objectives:	<p>Student should be able to:</p> <ol style="list-style-type: none">1. To learn basic preparation of various chemicals2. To learn basic operations and applications of common lab instruments3. To understand the fundamentals of instrumentation techniques such as electrophoresis, chromatography and centrifugation.4. To develop understanding of DNA isolation from different sources5. To estimate compounds like proteins, ascorbic acid and carbohydrate6. To study the effect of factors affecting enzyme activity7. To observe the enumeration of RBCs and WBCs
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Unit	Description
Section-I	
1.	Preparation of reagents Molar Solution, Normal Solution, Percentage Solutions
2.	To study the principle, working and applications of lab instruments <ul style="list-style-type: none">• Weighing Balance• pH meter• BOD incubator• Centrifuge• Homogenizer
3.	To study principle, instrumentation, working and applications of Colorimeter/UV-visible Spectrophotometer.
4.	Estimation of DNA by DPA method
5.	Analysis of urine- Normal using strip and biochemical test
6.	Analysis of Abnormal urine
Section-II	
1.	To study principle, instrumentation, working and applications of electrophoresis.
2.	Isolation of chromosomal DNA from bacterial cells.
3.	Isolation of Plasmid DNA by alkaline lysis method
4.	Agarose gel electrophoresis of genomic DNA and plasmid DNA



5.	Estimation of haemoglobin by cyanmethemoglobin method (Drabkin method)
6.	Estimation of total carbohydrates by anthrone method
7.	Estimation of reducing sugar by DNS method
Section-III	
1.	To study principle, instrumentation, working and applications of chromatography.
2.	Separation of plant pigments using chromatography
3.	Separation of amino acids by TLC
4.	Estimation of Ascorbic acid (Vitamin C)
5.	Estimation of hemoglobin by sahli's method
6.	Total RBC count
7.	Total WBC count
Section-IV	
1.	To study principle, instrumentation, working, types and applications of centrifugation.
2.	Estimation of total protein Bradford method
3.	Effect of the Enzyme (Invertase) Concentration on enzyme activity
4.	Effect of Substrate Concentration on enzyme activity
5.	Effect of time on enzyme activity
6.	Effect of pH on enzyme activity

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
