B.Sc. Biochemistry

(Semester with Choice Based Credits System)

Subjects in B.Sc. Biochemistry

I Year

I SEMESTER

S.NO.	SUBJECTS
1	**Nutritional Biochemistry**
2	**Practical I - Nutritional Biochemistry**
3	**Chemistry For Biological Sciences-I**
4	**Chemistry Practical For Physical And Biological Sciences**
5	**Medicinal Diet**
6	**Bridge Course: Basics Of Biochemistry For Beginners – Scope & Applications**

II SEMESTER

S.NO.	SUBJECTS
1	**Cell Biology**
2	**Practical II: Cell Biology**
3	**Chemistry For Biological Sciences-II**
4	**Chemistry Practical for Physical and Biological Sciences-II**
5	**NME: Life Style Diseases**
6	**SEC: First Aid**

II Year

III SEMESTER

S.NO.	SUBJECTS
1	**Biomolecules**
2	**Practical II: Biomolecules**
3	**Microbiology - I**
4	**SEC:Basics Of Forensic Science**

IV SEMESTER

S.NO.	SUBJECTS
1	**Biochemical Techniques**
2	**Practical Iv Biochemical Techniques**
3	**Microbiology - II**
4	**SEC:Biomedical Instrumentation**
5	**Value Education**

III Year

V SEMESTER

S.NO.	SUBJECTS
1	**Enzymes**
2	**Intermediary Metabolism**
3	**Clinical Biochemistry**
4	**Practical V Clinical Biochemistry**
5	**Immunology**
6	**Research Methodology**

VI SEMESTER

S.NO.	SUBJECTS
1	**Molecular Biology**
2	**Human Physiology**
3	**Biotechnology**
4	**Plant Biochemistry and Plant Therapeutics**

SEMESTER I		
Course Code :122C1A		
CORE-I: NUTRITIONAL BIOCHEMISTRY		
Learning Objectives The objectives of this course are to • Create awareness about the role of nutrients in maintaining proper health. • Understand the nutritional significance of carbohydrates, lipids and proteins. • Understand the importance of a balanced diet. • Study the effect of additives, emulsifiers, flavor enhancing substances in food. • Study the significance of nutraceuticals.		
Course Outcomes	CO1	Cognizance of basic food groups viz. Carbohydrates, proteins and lipids and their nutritional aspects as well as calorific value.
	CO2	Identify and explain nutrients in foods and the specific functions in maintaining health.
	CO3	Classify the food groups and its significance.
	CO4	Understand the effect of food additives.
	CO5	Describe the importance of nutraceuticals and pigments.

Course Code :122C11		
PRACTICAL I - NUTRITIONAL BIOCHEMISTRY		
Learning objectives The objectives of this course are to • Impart hands-on training in the estimation of various constituents by titrimetric method. • Prepare Biochemical preparations. • Determine the ash content and extraction of lipid.		
Course Outcomes	CO1	Estimate the important biochemical constituents in the food samples.
	CO2	Prepare the macronutrients from the rich sources.
	CO3	Determine the ash and moisture content of the food samples.
	CO4	Extract oil from its sources.

Course Code :122E1A		
CHEMISTRY FOR BIOLOGICAL SCIENCES-I		
Learning Objectives This course aims at providing knowledge on basics of atomic orbitals, chemical bonds, hybridization and fundamentals of organic chemistry, nuclear chemistry and industrial chemistry importance of specialty drugs and separation and purification techniques.		
Course Outcomes	CO1	State the theories of chemical bonding, nuclear reactions and its applications.
	CO2	Evaluate the efficiencies and uses of various fuels and fertilizers.
	CO3	Explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.
	CO4	Demonstrate the structure and uses of antibiotics, an aesthetics, antipyretics and artificial sugars.
	CO5	Analyze various methods to identify an appropriate method for the separation of chemical components.

Course Code: 122E11		
CHEMISTRY PRACTICAL FOR PHYSICAL AND BIOLOGICAL SCIENCES		
Course Outcomes	CO1	Gain an understanding of the use of standard flask and volumetric pipettes, burette.
	CO2	Design, carryout, record and interpret the results of volumetric titration.
	CO3	Apply their skill in the analysis of water/hardness.
	CO4	To create the awareness about food adulterants.

Course Code: 122S1C		
MEDICINAL DIET		
Learning Objective The main objectives of this course are to • Provide basic knowledge about diet. • Understand of diet modification for GI diseases. • Plan a diet for liver diseases. • Prepare diet chart for Infectious diseases. • Plan a diet for Diabetes, Renal and Cardio-vascular diseases.		
Course Outcomes	CO1	Possess basic knowledge about diet.
	CO2	Sketch diet plan for GI diseases.
	CO3	Sketch diet plan for liver diseases.
	CO4	Sketch a diet plan for Infectious diseases.
	CO5	Prepare diet chart for Diabetes Renal and Cardio-vascular diseases.

Course Code: 122B1A		
BRIDGE COURSE **BASICS OF BIOCHEMISTRY FOR BEGINNERS – SCOPE & APPLICATIONS**		
Learning Objectives • Understanding of Biochemistry as a discipline and milestone discoveries in life sciences that led to establishment of Biochemistry as separate discipline. And basic concepts of biomolecules. • Learning about micronutrients essential for life. • Learning the interdisciplinary nature of Biochemistry. • To create awareness on the scope and applications of Biochemistry. • Understanding good and safe laboratory practices.		
Course Outcomes	CO1	Establishing a stronger foundation in historical background and basic biomolecules of living system.
	CO2	Learning about micronutrients required for life.
	CO3	Awareness on the scope & interdisciplinary nature of Biochemistry.
	CO4	Knowing Career prospects in Biochemistry.
	CO5	Learning safety and good laboratory practices.

SEMESTER II

Course Code: **122C2A**

CELL BIOLOGY

Learning Objectives

- Provide basic understanding of architecture of cells and its organelles.
- Understand the organization of prokaryotic and eukaryotic genome.
- Educateonthestructuralorganizationofbiomembraneandtransportmechanism.
- Impart knowledge on cell cycle, cell division and basics of cells.
- Familiarize the concept of mechanism of cell-cell interactions.

Course Outcomes	CO1	Explain the structure and functions of basic components of prokaryote and eukaryotic cells, especially the organelles.
	CO2	Familiarize the cytoskeleton and chromatin.
	CO3	Illustrate the structure, composition and functions of cell membrane related to membrane transport.
	CO4	Elaborate the phases of cell cycle and cell division- Mitosis and meiosis and characteristics of cancer cells.
	CO5	Relate the structure and biological role of extracellular matrix in Cellular interactions.

Course Code: **122C21**

PRACTICAL II: CELL BIOLOGY

Learning Objectives

The main objectives of this course are to

- Learn the parts of microscope.
- Investigate the cells under microscope.
- Image the cells using different stains.
- Identify the cells, organelles and stages of cell division identify the spotters.

Course Outcomes	CO1	Identify the parts of microscope.
	CO2	Preparation of Slides.
	CO3	Identify the stages of mitosis & meiosis.
	CO4	Visualize nucleus and mitochondria by staining methods.
	CO5	Identify the spotters of cells, organelles and stages of cell division.

Course Code: 122E2A		
CHEMISTRY FOR BIOLOGICAL SCIENCES-II		
Learning Objectives This course aims to provide knowledge on • Nomenclature of coordination compounds and carbohydrates. • Amino Acids and Essential elements of bio system. • Understand the concepts of kinetics and catalysis. • Provide fundamentals of electrochemistry and photochemistry.		
Course Outcomes	CO1	Write the IUPAC name for complex, different theories to explain the bonding incoordination compounds and water technology.
	CO2	Explain the preparation and property of carbohydrate.
	CO3	Enlighten the biological role of transition metals, amino acids and nucleic acids.
	CO4	Apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.
	CO5	Outline the various type of photochemical process.

Course Code: 122E21		
CHEMISTRY PRACTICAL FOR PHYSICAL AND BIOLOGICAL SCIENCES-II		
Learning Objectives This course aims to provide knowledge on • Identification of organic functional groups. • Different types of organic compounds with respect to their properties. • Determination of elements in organic compounds.		
Course Outcomes	CO1	Gain an understanding of the use of test tubes, boiling tubes, fusion tubes.
	CO2	Design, carry out, record and interpret the results of organic analysis.
	CO3	Apply their skill in the analysis of functional group present in organic compounds.
	CO4	Analyze the chemical constituents in allied chemical products.

Course Code: 122S1B		
LIFE STYLE DISEASES		
Learning Objectives The objectives of this course are to • Create awareness on lifestyle diseases among adolescents. • List out the lifestyle diseases. • Explain the common lifestyle diseases and their prevention. • Acquaint the disorders associated with women's health. • Impart life skills so as to prevent lifestyle diseases.		
Course Outcomes	CO1	Define Life style diseases and describe the contributing Factors.
	CO2	Enumerate the top life style diseases and its impact on life.
	CO3	Elaborate the treatment and prevention measures of common lifestyle diseases.
	CO4	Highlight the life style diseases that affects the women's health.
	CO5	Illustrate the various measures for prevention of life style diseases.

Course Code: 22SEC3		
FIRST AID		
Learning objectives The main objectives of this course are to • Provide knowledge on the basics of first aid. • Perform first aid during various respiratory issues. • Demonstrate the first aid to treat injuries. • Learn the first aid techniques to be given during emergency. • Familiarize the first aid during poisoning.		
Course Outcomes	CO1	Discuss on the rules of first aid, dealing during emergency and first aid techniques.
	CO2	Understand the first aid techniques to be given during different types of respiratory problems.
	CO3	Provide first aid for injuries, shocks and bone injury.
	CO4	Detail on the first aid to be given for unconsciousness, stroke, fits and convulsions.
	CO5	Gain expertise in giving first aid for insect bites and chemical poisoning.

SEMESTER III

Course Code: 222C3A

BIOMOLECULES

Learning objectives

The main objectives of this course are to:

- Introduce the structure, properties and biological significance of carbohydrates.
- Comprehend the classification, functions and acid base properties of amino acids.
- Elucidate the various levels of organization of Proteins.
- Impart knowledge on the classification, properties and characterization of lipids.
- Acquaint with the classification, structure, properties and functions of nucleic acids.

Course Outcomes	CO1	Classify, illustrate the structure and explain the physical and chemical properties of carbohydrates.
	CO2	Indicate the classification, structure, properties and biological functions of amino acids.
	CO3	Explain the classification and elucidate the different levels of structural organization of proteins.
	CO4	Elaborate on classification, structure, properties, functions and characterization of lipids.
	CO5	Describe the structure, properties and functions of different types of nucleic acids.

Course Code: **222C31**

PRACTICAL III BIOMOLECULES

Learning objectives

The main objectives of this course are to

- Identify the biomolecules carbohydrates and amino acids by qualitative test.
- Determine the quality of Lipids by titrimetric methods, isolate nucleic acids from plant and animal source.

Course Outcomes	CO1	Qualitatively analyses the carbohydrates and report the type of carbohydrate based on specific tests.
	CO2	Qualitatively analyze amino acids and report the type of amino acids based on specific tests.
	CO3	Determine the Saponification Iodine and acid number of edible oil.
	CO4	Isolate the nucleic acid from biological sources.
	CO5	Qualitatively analyses the carbohydrates and report the type of carbohydrate based on specific tests.

Course Code: 222E3D		
MICROBIOLOGY - I (THEORY)		
Learning Objectives The main objectives of this course are to • To study about the microscope, and identify various bacterial cells. • Determine the staining and culture techniques.		
Course Outcomes	CO1	Outline landmark events in the History of microbiology and to classify Microorganisms into taxonomic groups.
	CO2	Describe the structural and functional make up of a bacteria.
	CO3	Compile various staining and cultivation techniques.
	CO4	Expose to techniques for obtaining pure cultures of microorganismswith knowledge on methods of measuring microbial growth.
	CO5	Get acquainted with sterilization and preservation techniques.

Course Code:22SEC1		
BASICS OF FORENSIC SCIENCE		
Learning Objectives The main objectives of this course are to • Gain knowledge on the basic practices of forensic analysis. • Perform investigation using fresh blood. • Carry out the analysis using body fluids. • Investigate the presence of forms of drugs and poisons in body fluids. • Execute the identification test on multiple samples.		
Course Outcomes	CO1	Gain knowledge on basics of forensic science and method for collection and preservation of samples.
	CO2	Assess the paternity, maternity problems and DNA profiling.
	CO3	Identify the presence of alcohol, insecticides and pesticides in body fluids.
	CO4	Detail on the test performed to identify the presence of drugs and poisons in body fluids.
	CO5	Identify species and sex from the available body fluids.

SEMESTER IV

Course Code: 222C4A

BIOCHEMICAL TECHNIQUES

Learning objectives

The objectives of this course are to

- Introduce the basic principles, types and applications of various sedimentation technique.
- Provide an understanding of the underlying principles of chromatographic techniques.
- Demonstrate experimental skills in various electrophoretic techniques.
- Appraise the use of colorimetric and spectroscopic techniques in biology.
- Impart knowledge about the measurement of radioactivity and safety aspects of radioactive isotopes.

Course Outcomes	CO1	Describe types of rotors and identify the centrifugation technique for the separation of biomolecules.
	CO2	Demonstrate the principles, operational procedures and applications of planar and column chromatography.
	CO3	Specify the factors and explain the separation of DNA and protein using the electrophoretic technique.
	CO4	State Beer's Law and illustrate the instrumentation and uses of the colorimeter and spectrophotometer.
	CO5	Enumerate various methods of measurement of radioactivity and safety aspects of radioactive isotopes.

Course Code: 222C41		
PRACTICAL IV BIOCHEMICAL TECHNIQUES		
Learning objectives The objectives of this course are to: • Acquaint the students with colorimetric estimations of biomolecules. • Equip skills on various separation techniques. • Impart knowledge about the estimation of minerals and vitamins.		
Course Outcomes	CO1	Estimate the number of biomolecules by Colorimetric method.
	CO2	Quantify the amount of minerals by Colorimetric Method.
	CO3	Separate and identify sugars, lipids and amino acids by chromatography.
	CO4	Operate centrifuge for the separation of serum and plasma.
	CO5	Demonstrate the separation of proteins electrophoretically.

Course Code: 222E4D		
MICROBIOLOGY - II (THEORY)		
Course Outcomes	CO1	Focus on Microbial spoilage, preservation, testing and production of food products.
	CO2	Explain types of soil microbes with their role in the various Bio Geo cycles and their applications.
	CO3	Discuss the different sources of water, their purification methods and threats of water borne diseases.
	CO4	Explain the composition of air, its quality with remedial sanitary measures to combat air borne diseases.
	CO5	Get insights on industrial production of human utility products and regulatory bodies of Environmental pollution.

Course Code:22SEC2

BIOMEDICAL INSTRUMENTATION

Learning Objectives

The objectives of this course are to

- Provide insights about the blood pressure and its measurement.
- Elaborate the mechanism of instruments related to respiration.
- Highlight the importance of imaging techniques.
- Acquaint students about the basics of medical assisting devices.
- Familiarize about the life saving therapeutic equipment's.

Course Outcomes	CO1	Illustrate the functions of instruments used for measuring blood pressure.
	CO2	Elaborate the devices required for monitoring of respiratory gases.
	CO3	Understand the operation of the imaging and sonographic instruments.
	CO4	Differentiate between the action of pacemakers, defibrillators and ventilators.
	CO5	Demonstrate the function of therapeutic equipment's.

Course Code:200V4Q

VALUE EDUCATION

Learning Objectives

The main objectives of this course are to

- To create awareness on the different values of life.
- To impact knowledge on commitment of life towards work.
- To gain knowledge on different human rights.
- To understand the balance between the environment and ecology.

Course Outcomes	CO1	Describes the purpose and significance of value education in the present world.
	CO2	Brief the salient values for life.
	CO3	Demonstrate the various Human rights.
	CO4	Discuss the role of humans in maintaining the ecological balance.
	CO5	Highlights the ways to tackle the various social evils in life.

SEMESTER V

Course Code: **322C5A**

ENZYMES

Learning objectives

The main objectives of this course are to

- Provide fundamental knowledge on enzymes and their properties.
- Understand the mechanism of action of enzymes and the role of coenzymes in catalysis.
- Introduce the kinetics of enzymes and determine the Km and Vmax.
- Explain the effect of inhibitors on enzyme activity.
- Understand the role of enzymes in clinical diagnosis and industries.

Course Outcomes	CO1	Identify the major classes of enzymes, differentiate between a chemical catalyst and a biocatalyst and define the units of enzymes.
	CO2	Explain the mechanism of enzyme catalysis and the role of coenzymes in enzyme action.
	CO3	Illustrate the steady state kinetics, interpret M M plot and LB plot based on kinetics data, and determine Km and Vmax.
	CO4	Distinguish the types of inhibition along with its importance in biochemical reactions.
	CO5	Comprehend the various methods for production of immobilized enzymes anddiscuss the application of enzymes in clinical diagnosis and various industries.

Course Code :322C5B

INTERMEDIARY METABOLISM

Learning objectives

The main objectives of this course are to

- Review the basic concepts of free energy transformation and describe biological oxidation.
- Illustrate the pathways of carbohydrate metabolism.
- Explain the pathways of oxidation and biosynthesis of lipids.
- Detail the catabolism of amino acids and synthesis of specialized products from amino acids.
- Acquaint the metabolism of nucleic acids and its regulation.

Course Outcomes	CO1	State the concepts of bioenergetics and illustrate the mechanism of flow of electrons and the production of ATP.
	CO2	Elaborate the biochemical reactions and integration of pathways of carbohydrate metabolism.
	CO3	Sketch the oxidation and biosynthesis of fatty acids, phospholipids, triglycerides and cholesterol with suitable examples.
	CO4	Explain catabolism of amino acids, synthesis of nonessential amino acids and specialized products from amino acids.
	CO5	Describe the metabolism of nucleic acids with necessary illustrations and its regulation.

Course Code :**322C5C**

CLINICAL BIOCHEMISTRY

Learning objectives

The main objectives of this course are to

- Comprehend the basic concepts and disorders of carbohydrate metabolism.
- Explain the disorders of lipid metabolism.
- Elucidate the liver function test and kidney function test.
- Designate the gastric function test.
- Familiarize the clinical enzymology.

Course Outcomes	CO1	Explain the concepts of hormones and their importance to maintain glucose and types of Diabetes, diagnosis and treatment.
	CO2	Analyze the lipid profile and different deficiency state.
	CO3	Describe the liver and kidney functions and specific diagnostic methods used for biological sample.
	CO4	Detail about the composition of gastric juice and special test for diagnosis.
	CO5	Elaborate the enzyme markers used for diagnostic studies.

Course Code :**322C51**

PRACTICAL V CLINICAL BIOCHEMISTRY

Learning objectives

The objectives of this course are to

- Introduce the methods of sample collection (blood & urine) for analytical purpose.
- Impart practical knowledge on the assay of activity of various diagnostically important enzymes.
- Understand the estimation procedure for various important biomolecules.
- Help students learn the routine qualitative analysis of a urine sample for diagnostic purpose.
- Train students on various hematological tests and its significance.

Course Outcomes	CO1	Acquaint knowledge on collection of biological samples (urine, blood). And their preparation for diagnostic purpose.
	CO2	Assay the activity of various clinically important enzymes and relate. Their clinical importance.
	CO3	Estimate the important biomolecules in biological samples and relate their clinical significance.
	CO4	Qualitatively analyze urine sample for normal and abnormal Constituents in urine and interpret the results.
	CO5	Perform the routine hematological tests.

Course Code:322E5A

IMMUNOLOGY

Learning objectives

The objective of this course is to

- Introduce the structure and functions of lymphoid organs and cells of the immune system.
- Illustrate the structure and classification of antibodies and adaptive immune response.
- Impart knowledge on the types of immunity and uses of vaccines.
- Provide an understanding of immune related diseases and transplantation.
- Study the Ag-Ab interaction and immunological techniques to identify antigens and antibodies.

Course Outcomes	CO1	Associate structure and function of the organs involved in our body's natural Defense.
	CO2	Classify antigens and antibodies, and the role of lymphocytes in defending the host.
	CO3	Describe the types of immunity and the uses of vaccines.
	CO4	Understand the immune-related diseases and the mechanism of transplantation.
	CO5	Examine the immunological tests and relate them to the immune status of an Individual.

Course Code:322E5C

RESEARCH METHODOLOGY

Learning objectives

The objectives of the course are to:

- Introduce the components of research.
- Acquaint on the experimental design and literature survey
- Analyse the data and find out the significance statistically
- Highlight the importance of computation in research.
- Provide mechanics of writing a research report hands-on experience in designing and working on small projects.
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Course Outcomes	CO1	Explain the types of research and formulate and plan the research.
	CO2	Design experimental setup, review the literature, compile and document the data.
	CO3	Analyze and validate the experimental data using statistical tools.
	CO4	Interpret the data using computational tools.
	CO5	Compile and draft a research report, present results findings and publish ethically.

SEMESTER VI

Course Code: **322C6A**

MOLECULAR BIOLOGY

Learning objectives

The objectives of this course are to

- Provide insights into the central dogma of molecular biology and explain the mechanism of DNA replication.
- Elaborate on the mechanism of transcription and Reverse transcription.
- Highlight the characteristics of the genetic code and describe the Process of protein synthesis.
- Introduce the concept of regulation of gene expression in Prokaryotes.
- Familiarize the different types of mutations and explain the Mechanism of DNA repair.

Course Outcomes	CO1	Illustrate the Central Dogma of molecular biology, explain the multiplication of DNA in the cell and describe the types and modes of replication.
	CO2	Elaborate the mechanism of transcribing DNA into RNA, discuss the formation of different types of RNA.
	CO3	Decipher the genetic code and summarize the process of translation.
	CO4	Comprehend the principles of gene expression and explain the concept of operon in prokaryotes.
	CO5	Distinguish the types of mutations and explain the various mechanisms of DNA repair.

Course Code:322C6B

HUMAN PHYSIOLOGY

Learning objectives

The main objectives of this course are to

- Aid in understanding the physiology of the respiratory and circulatory systems.
- Explain the structure and physiology of the nervous and muscular systems.
- Explicate the functions of the digestive and excretory system of the body.
- Impart knowledge about the process of reproduction.
- Emphasize the importance of various endocrine factors that regulate metabolism, growth, homeostasis, and reproduction.

Course Code:322E6A		
BIOTECHNOLOGY		
Course Outcomes	CO1	Acquire knowledge on rDNA technology, DNA manipulation, and use of restriction endonuclease.
	CO2	Get acquainted with the use of cloning and vectors in plant tissue culture.
	CO3	Understand the methods for production of proteins using recombinant DNA technology and their applications, basics of tissue culture, trans genesis, stem cell technology, risks, and safety aspects and patenting in biotechnology.
	CO4	Gain knowledge about the importance of gene and gene manipulation technologies.
	CO5	Know the concept fermentation technology and its applications.

Course Code:322E6D		
PLANT BIOCHEMISTRY AND PLANT THERAPEUTICS		
Learning Objectives The main objectives of this course are to • Convey the knowledge of photosynthesis. • Detail the structure and types of secondary metabolites. • Impart the idea on various plant hormones. • Emphasize the effects of free radicals and the importance of antioxidants. • Understand the role of medicinal plants in treating diseases.		
Course Outcomes	CO1	Gain knowledge on photosynthetic apparatus, pigments present, pathways, and significance of photosynthesis
	CO2	Learn in detail about the structure, types, sources, biosynthesis and functions of secondary metabolites.
	CO3	Understand the structure and functions of plant hormones.
	CO4	Discuss about free radicals, types and its harmful effects. Role of enzymatic and non-enzymatic antioxidant in defense mechanism, prevention in disease.
	CO5	Identify the plants with antidiabetic, anticancer, antibacterial, antiviral, anti-malaria and anti-inflammatory properties.