

Semester – I				
Course Code	Course Type	Course Title	Credits	Lectures/Week
SBT101	Core Subject	Basic Chemistry-I	2	3
SBT102	Core Subject	Basic Chemistry-II	2	3
SBT103	Core Subject	Basic Life Sciences-I : Biodiversity and Cell Biology	2	3
SBT104	Core Subject	Basic Life Sciences-II : Microbial Techniques	2	3
SBT105	Core Subject	Basic Biotechnology-I : Introduction to Biotechnology	2	3
SBT106	Core Subject	Basic Biotechnology-II : Molecular Biology	2	3
SBT107	Ability Enhancement Course 1 (FC I)	Societal Awareness	2	3
SBTP101, SBTP102, SBTP103	Core Subject Practicals	Practicals of SBT101, SBT102, SBT103, SBT104, SBT105 and SBT106	6	18
Semester – II				
Course Code	Course Type	Course Title	Credits	Lectures/Week
SBT201	Core Subject	Chemistry-I : Bioorganic Chemistry	2	3
SBT202	Core Subject	Chemistry-II : Physical Chemistry	2	3
SBT203	Core Subject	Life Sciences-I : Physiology and Ecology	2	3
SBT204	Core Subject	Life Sciences-II : Genetics	2	3
SBT205	Core Subject	Biotechnology-I : Tissue Culture & Scientific Writing and Communication Skills	2	3
SBT206	Core Subject	Biotechnology-II : Enzymology, Immunology and Biostatistics	2	3
SBT207	Ability Enhancement Course 2 (FC II)	Globalization, Ecology and Sustainable Development	2	3
SBTP201, SBTP202, SBTP203	Core Subject Practicals	Practicals of SBT201, SBT202, SBT203, SBT204, SBT205 and SBT206	6	18

COURSE OUTCOME FOR BIOTECHNOLOGY

F.Y.BSc Sem I

SBT 101

Basic Chemistry I

Course Objective : To acquaint the students with basic concepts of Chemistry like Classification and Nomenclature of Chemical compounds

Learning Outcome : To impart hands-on skills in preparation of Buffers and Solutions

SBT 102

Basic Chemistry II

Course Objective : To acquaint students with Concepts of Stereochemistry

Learning Outcome : To impart knowledge of Titrimetric and Volumetric Estimations and handling of basic Analytical Techniques like Chromatography and Colorimetry

SBT 103

Life Science I

Biodiversity and Cell Biology

Course Objectives: To acquaint students with concept of Biodiversity and Cell Biology

Learning Outcome : To impart skill in handling and culture of Microorganisms

SBT 104

Life Science II

Microbial Techniques

Course Objectives: To acquaint students with basic techniques in Staining and Sterilization

Learning Outcome: To impart the knowledge of growth of microorganisms

SBT 105

Biotech I

Introduction to Biotechnology

Course Objectives : To acquaint students with various fields of Biotechnology and their applications

Learning Outcome : To impart the knowledge of Food Technology and Fermentation Techniques

SBT 106

Biotech II

Molecular Biology

Course Objectives : To acquaint students with DNA Replication, Repair and Genetic Engineering

Learning Outcome: Impart the knowledge of molecular Biology Techniques

SBT 107

Ability Enhancement (FC I)

Social Awareness

Course Objective : To acquaint the students with concepts of Societal Awareness

Learning Outcome : To impart knowledge of Society and make students aware about the Problems in Society

F.Y.BSc Sem II

SBT 201

Basic Chemistry I

Bioorganic chemistry

Course Objectives : To acquaint students with Bioorganic Molecules

Learning Outcome : To impart the knowledge of Classification, Structure and Characterization of Biomolecules

SBT 202

Basic Chemistry II

Physical Chemistry

Course Objectives : To acquaint students with concepts in Thermodynamics, Kinetics and Redox Reactions

Learning Outcome : To impart skills in Kinetics and Chemical Reactions

SBT 203

Life Science I

Physiology and ecology

Course Objectives: To acquaint students with Physiological Processes in Plants and Animals

Learning Objectives : To impart the knowledge of Physiology and Ecology

SBT 204

Life Science II

Genetics

Course Objectives : To acquaint students with concepts in Genetics

Learning Objectives: To impart skills in Techniques in Genetic Analysis and Population Genetics

SBT 205

Biotech I

Tissue Culture & Scientific

Writing and Communication

Skills

Course Objectives : To acquaint students with Techniques of Plant and Animal Tissue Culture

Learning Outcome : To impart the skills of PTC, ATC and Science Communication

SBT 206

Biotech II

Enzymology, Immunology and

Biostatistics

Course Objectives : To acquaint students with concepts in Enzymology, Immunology and Biostatistics

Learning Outcome: To impart the skills in Enzyme Kinetics, Immunological Techniques and Biostatistics

SBT 207

Ability Enhancement (FC II)

Globalization, Ecology and

Sustainable Development

Course Objective : To acquaint the students with concepts of Globalization, Ecology and Environment

Learning Outcome : To impart knowledge of Globalization make students aware about the Problems in Society.

SEMESTER – I
THEORY

SEMESTER I

Basic Chemistry-I

COURSE CODE	TITLE	CREDITS
SBT 101	Basic Chemistry I	2
Unit I Nomenclature and Classification	<p>Nomenclature and Classification of Inorganic Compounds: Oxides, Salts, Acids, Bases, Ionic, Molecular and Coordination Compounds</p> <p>Nomenclature and Classification of Organic Compounds: Alkanes, Alkenes, Alkynes, Cyclic Hydrocarbons, Aromatic Compounds, Alcohols and Ethers, Aldehydes and Ketones, Carboxylic Acids and its derivatives, Amines, Amides, Alkyl Halides and Heterocyclic Compounds</p>	15 Lectures
Unit II Chemical Bonds	<p>Chemical Bonds:</p> <p>Ionic Bond: Nature of Ionic Bond, Structure of NaCl, KCl and CsCl, factors influencing the formation of Ionic Bond.</p> <p>Covalent Bond: Nature of Covalent Bond, Structure of CH₄, NH₃, H₂O, Shapes of BeCl₂, BF₃</p> <p>Coordinate Bond: Nature of Coordinate Bond</p> <p>Non Covalent Bonds: Van Der Waal's forces: dipole - dipole, dipole – induced dipole.</p> <p>Hydrogen Bond: Theory of Hydrogen Bonding and Types of Hydrogen Bonding (with examples of RCOOH, ROH, Salicylaldehyde, Amides and Polyamides).</p>	15 Lectures
Unit III Water and Buffers	<p>Chemistry of Water: Properties of Water, Interaction of Water with Solutes (Polar, Non-Polar, Charged), Non-Polar Compounds in Water – Change in its Structure and the Hydrophobic Effect, Role of Water in Biomolecular Structure and Function and Water as a Medium for Life</p>	15 lectures

	<p>Solutions: Normality, Molarity, Molality, Mole fraction, Mole concept, Solubility, Weight ratio, Volume ratio, Weight to Volume ratio, ppb, ppm, millimoles, milliequivalents (Numericals expected).</p> <p>Primary and Secondary Standards: Preparation of Standard Solutions, Principle of Volumetric Analysis.</p> <p>Acids and Bases: Lowry-Bronsted and Lewis Concepts. Strong and Weak Acids and Bases - Ionic Product of Water - <i>pH, pKa, pKb</i>. Hydrolysis of Salts.</p> <p>Buffer solutions –Concept of Buffers, Types of Buffers, Derivation of Henderson equation for Acidic and Basic buffers, Buffer action, Buffer capacity (Numericals expected.) pH of Buffer Solution.</p>	
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SEMESTER I

Basic Chemistry-II

COURSE CODE	TITLE	CREDITS
SBT 102	Bioorganic Chemistry I	2
Unit I Stereochemistry	<p>Isomerism – Types of Isomerism: Constitutional Isomerism (Chain, Position and Functional) and Stereoisomerism, Chirality.</p> <p>Geometric Isomerism and Optical Isomerism: Enantiomers, Diastereomers, and Racemic mixtures Cis-Trans, Threo, Erythro and Meso isomers. Diastereomerism (Cis-Trans Isomerism) in Alkenes and Cycloalkanes (3 and 4 membered ring)</p> <p>Conformation: Conformations of Ethane. Difference between Configuration and Conformation.</p> <p>Configuration, Asymmetric Carbon Atom, Stereogenic/ Chiral Centers, Chirality,</p>	15 Lectures

	<p>Representation of Configuration by –Flying Wedge Formulal</p> <p>Projection formulae – Fischer, Newman and Sawhorse. The Interconversion of the Formulae.</p>	
<p>Unit II Titrimetry and Gravimetry</p>	<p>Titrimetric Analysis: Titration, Titrant, Titrand, End Point, Equivalence Point, Titration Error, Indicator, Primary and Secondary Standards, Characteristics and examples</p> <p>Types of Titration –Acid –Base, Redox. Precipitation, Complexometric Titration. Acid – Base Titration.-Strong Acid Vs Strong Base -Theoretical aspects of Titration Curve and End Point Evaluation. Theory of Acid –Base Indicators, Choice and Suitability of Indicators.</p> <p>Gravimetric Analysis: Solubility and Precipitation, Factors affecting Solubility, Nucleation, Particle Size, Crystal Growth, Colloidal State, Ageing/Digestion of Precipitate. Co-Precipitation and Post-Precipitation. Washing, Drying and Ignition of Precipitate. (Numericals Expected).</p>	15 Lectures
<p>Unit III Analytical Techniques</p>	<p>Methods of Seperation Precipitation, Filtration, Distillation and Solvent Extraction.</p> <p>Analytical Techniques Chromatography: Definition, Principles, Types Introduction to Paper Chromatography, Thin Layer Chromatography, Column Chromatography and its Applications.Colorimetry: Principle, Beer-Lambert’s Law, Measurement of Extinction, Derivation of $E = kcl$, Limitations of Beer-Lambart’s Law, Filter Selection</p>	15 Lectures

SEMESTER I

Basic Life Sciences-I : Biodiversity and Cell Biology

COURSE CODE	TITLE	CREDITS
SBT 103	Biodiversity and Cell Biology	2
<p style="text-align: center;">Unit I Origin of Life and Biodiversity (Animal, Plant, Microorganisms)</p>	<p>Origin of Life, Chemical and Biological Evolution, Origin of Eukaryotic Cell.</p> <p>Concept of Biodiversity, Taxonomical, Ecological and Genetic Diversity & its Significance</p> <p>Introduction to Plant Diversity: Algae, Fungi, Bryophyta, Pteridophyta, Gymnosperms and Angiosperms (with one example each)</p> <p>Introduction to Animal Diversity: Non-Chordates and Chordates {with at least one representative example.}</p> <p>Introduction to Microbial Diversity Archaeobacteria, Eubacteria, Blue-green Algae, Actinomycetes, Eumycota- Habitats, Examples and Applications.</p>	15 Lectures
<p style="text-align: center;">Unit II Ultra Structure of Prokaryotic and Eukaryotic Cell.</p>	<p>Ultrastructure of Prokaryotic Cell: Concept of Cell Shape and Size. Detail Structure of Slime Layer, Capsule, Flagella, Pili, Cell Wall (Gram Positive and Negative), Cell Membrane, Cytoplasm and Genetic Material Storage Bodies and Spores</p> <p>Ultrastructure of Eukaryotic Cell: Plasma membrane, Cytoplasmic Matrix, Microfilaments, Intermediate Filaments, and Microtubules Organelles of the Biosynthetic- Endoplasmic Reticulum & Golgi Apparatus. Lysosome, Endocytosis, Phagocytosis, Autophagy, Proteasome Eucaryotic Ribosomes, Mitochondria and Chloroplasts</p>	15 Lectures

	<p>Nucleus –Nuclear Structure, Nucleolus</p> <p>External Cell Coverings: Cilia And Flagella</p> <p>Comparison of Prokaryotic And Eukaryotic Cells</p>	
<p>Unit III Bacteria and Viruses</p>	<p>Bacteria : Classification, Types, Morphology (Size, Shape and Arrangement) Cultivation of Bacteria. Reproduction and Growth (Binary Fission, Conjugation and Endospore formation) Growth Kinetics, Isolation and Preservation. Significance of Bacteria</p> <p>Viruses :General Characters, Classification (Plant, Animal and Bacterial Viruses) Structure and Characterization of Viruses and Significance</p>	15Lectures

SEMESTER - I

Basic Life Sciences-II : Microbial Techniques

COURSE CODE	TITLE	CREDITS
SBT 104	Microbial Techniques	2
<p>Unit I Microscopy and Stains</p>	<p>Microscopy and Stains Microscope- Simple and Compound: Principle. Parts, Functions and Applications. Dark Field and Phase Contrast Microscope Stains and Staining Solutions- Definition of Dye and Chromogen. Structure of Dye and Chromophore. Functions of Mordant and Fixative. Natural and Synthetic Dyes. Simple Staining, Differential Staining and Acid Fast Staining with specific examples</p>	15 lectures
<p>Unit II Sterilization Techniques</p>	<p>Definition : Sterilization and Disinfection. Types and Applications Dry Heat, Steam under pressure,</p>	15 lectures

	<p>Gases, Radiation and Filtration Chemical Agents and their Mode of Action - Aldehydes, Halogens, Quaternary Ammonium Compounds, Phenol and Phenolic Compounds, Heavy Metals, Alcohol, Dyes, and Detergents</p> <p>Ideal Disinfectant. Examples of Disinfectants and Evaluation of Disinfectant</p>	
<p>Unit III Nutrition, Cultivation and Enumeration of Microorganisms</p>	<p>Nutrition and Cultivation of Microorganisms Nutritional Requirements : Carbon, Oxygen, Hydrogen, Nitrogen, Phosphorus, Sulphur and Growth Factors. Classification of Different Nutritional Types of Organisms. Design and Types of Culture Media. Simple Medium, Differential, Selective and Enrichment Media Concept of Isolation and Methods of Isolation. Pure Culture Techniques Growth and Enumeration Growth Phases, Growth Curve. Arithmetic Growth and Growth Yield. Measurement of Growth. Chemostat and Turbidostat Enumeration of Microorganisms- Direct and Indirect Methods Preservation of Cultures- Principle and Methods. Cryogenic Preservation Advantages and Limitations</p>	15 lectures

SEMESTER I

Basic Biotechnology-I : Introduction to Biotechnology

COURSE CODE	TITLE	CREDITS
SBT 105	Introduction to Biotechnology	2
<p>Unit I Scope and Introduction to Biotechnology</p>	<p>History & Introduction to Biotechnology What is Biotechnology? Definition of Biotechnology, Traditional and Modern Biotechnology, Branches of Biotechnology-</p>	15 lectures

	<p>Plant, Animal Biotechnology, Marine Biotechnology, Agriculture, Healthcare, Industrial Biotechnology, Pharmaceutical Biotechnology, Environmental Biotechnology.</p> <p>Biotechnology Research in India.</p> <p>Biotechnology Institutions in India (Public and Private Sector)</p> <p>Biotech Success Stories</p> <p>Biotech Policy Initiatives</p> <p>Biotechnology in context of Developing World</p> <p>Public Perception of Biotechnology</p>	
<p>Unit II Applications Biotechnology</p>	<p>Applications of Biotechnology in Agriculture : GM Food, GM Papaya, GM Tomato, Fungal and Insect Resistant Plants</p> <p>BT Crops, BT Cotton and BT Brinjal</p> <p>Pros and Cons</p> <p>Biotechnological applications in Crop and Livestock Improvements</p> <p>Modifications in Plant Quality</p> <p>Golden Rice,</p> <p>Molecular Pharming, Plant Based Vaccines</p> <p>Ethics in Biotechnology and IPR</p>	15 lectures
<p>Unit III Food and Fermentation Biotechnology</p>	<p>Food Biotechnology</p> <p>Biotechnological applications in enhancement of Food Quality</p> <p>Unit Operation in Food Processing</p> <p>Quality Factors in Preprocessed Food</p> <p>Food Deterioration and its Control</p> <p>Rheology of Food Products</p> <p>Microbial role in food products Yeast, Bacterial and other Microorganisms based process and products</p> <p>Modern Biotechnological Regulatory Aspects in Food Industries</p> <p>Biotechnology and Food - Social Appraisal</p> <p>Fermentation Technology</p> <p>Definition, Applications of Fermentation Technology</p> <p>Microbial Fermentations</p> <p>Overview of Industrial Production of Chemicals (Acetic Acid, Citric Acid and Ethanol), Antibiotics, Enzymes and Beverages</p>	15 lectures

SEMESTER - I

Basic Biotechnology-II : Molecular Biology

COURSE CODE	TITLE	CREDITS
SBT 106	Molecular Biology	2
Unit I Replication	DNA Replication in Prokaryotes and Eukaryotes- Semi-conservative DNA replication, DNA Polymerases and its role, E.coli Chromosome Replication, Bidirectional Replication of Circular DNA molecules. Rolling Circle Replication, DNA Replication in Eukaryotes DNA Recombination – Holliday Model for Recombination Action of Telomerases	15 lectures
Unit II Mutation and DNA Repair	Definition and Types of Mutations. Mutagenesis and Mutagens.(Examples of Physical, Chemical and Biological Mutagens) Types of Point Mutations, DNA repair, Photoreversal, Base Excision Repair, Nucleotide Excision Repair, Mismatch Repair, SOS Repair and Recombination Repair.	15 lectures
Unit III Genetic Engineering	Experimental evidences for DNA and RNA as Genetic Material. Genetic Engineering in <i>E.coli</i> and other Prokaryotes, Yeast, Fungi and Mammalian Cells Cloning Vectors-Plasmids (pBR 322, pUC) Vectors for Plant and Animal Cells, Shuttle Vectors, YAC Vectors, Expression Vectors Enzymes- DNA Polymerases, Restriction Endonucleases, Ligases, Reverse Transcriptases, Nucleases, Terminal Transferases, Phosphatases Isolation and Purification of DNA (Genomic, Plasmid) and RNA,, Identification of Recombinant Clones	15 lectures

Semester – I
Practicals

SEMESTER – I
Practicals
Basic Chemistry

COURSE CODE	TITLE	CREDITS	Notional Hours
SBTP 101	Basic Chemistry	2	30 hrs
<ol style="list-style-type: none"> 1. Safety Measures and Practices in Chemistry Laboratory, Working and use of a Digital Balance, Functioning and Standardization of <i>pH</i> Meter, Optical Activity of a Chemical Compounds by Polarimeter 2. Preparation of Standard (Molar, Molal and Normal solutions) and Buffer Solutions Determination of strength of HCl in commercial sample 3. Qualitative Analysis of Inorganic Compounds - Three experiments 4. Characterization of Organic Compounds containing only C, H, O elements (no element test) - Compounds belonging to the following classes: Carboxylic Acid, Phenol, Aldehyde/Ketone, Ester, Alcohol, Hydrocarbon and Characterization of Organic Compounds containing C, H, O, N, S, Halogen Elements (element tests to be done) Compounds belonging to the following classes: Amine, Amide, Nitro Compounds, Thiamide, Haloalkane, Haloarene 5. To Standardize commercial sample of NaOH using KHP (Potassium hydrogen phthalate) and sample of HCl using borax. 6. Dissociation Constant of Weak Acids by Incomplete Titration Method using <i>pH</i> Meter and determination of Acetic acid in Vinegar by Titrimetric Method 7. Determination of the amount of Fe (II) present in the given solution Titrimetrically 8. Determination of amount of NaHCO₃ + Na₂CO₃ in the given solid mixture Titrimetrically 9. Determination of the amount of Mg (II) present in the given solution complexometrically 10. Determination of percent composition of BaSO₄ and NH₄Cl in the given mixture Gravimetrically 11. Separation of Cu, Ni and Fe using Paper Chromatography and amino acids - paper chromatography 12. Determination of fluoride ion using Colorimetry and Fe (III) by using Salicylic Acid by Colorimetric Titration 			

SEMESTER – I
Practicals
Basic Life Sciences

COURSE CODE	TITLE	CREDITS	Notional Hours
SBTP 102	Basic Life Science	2	30 hrs
<ol style="list-style-type: none"> 1. Components and working of Simple, Compound, Dark Field, Fluorescent and Phase Contrast Microscope 2. Staining of Plant and Animal Tissues using Single and Double Staining Techniques 3. Special Staining Technique for Cell Wall, Capsule and Endospores and Fungal Staining 4. Monochrome Staining, Differential Staining, Gram Staining, and Acid Fast Staining and Romanowsky Staining 5. Study of Plant, Animal and Microbial Groups with at least one examples from each x 3 6. Study of Photomicrographs of Cell Organelles 7. Sterilization of Laboratory Glassware and Media using Autoclave 8. Preparation of Media- Nutrient broth and Agar, MacConkey Agar, Saborauds Agar 9. Isolation of Organisms : T-streak, Polygon method 10. Enumeration of microorganisms by Serial Dilution, Pour Plate, Spread Plate Method 11. Colony Characteristics of Microorganisms, Enumeration by Breed's count 12. Growth Curve of <i>E.coli</i> 			

SEMESTER – I
Practicals
Basic Biotechnology

COURSE CODE	TITLE	CREDITS	Notional Hours
SBTP 103	Basic Biotechnology	2	30 hrs
<ol style="list-style-type: none">1. Assignment- Study of any branch of biotechnology and its applications2. Microbial examination of food and detection of Pathogenic Bacteria from Food Samples3. Isolation of organisms causing Food Spoilage4. Microscopic determination of Microbial flora from Yoghurt and Lactic Acid Determination5. Analysis of Milk- Methylene Blue, Resazurin Test, Phosphatase Test6. Extraction of Caesin from Milk7. Meat Tenderization using Papain8. Isolation and purification of DNA (genomic, plasmid)9. Restriction Digestion10. Agarose Gel Electrophoresis of the genomic and plasmid DNA			

SEMESTER – II
THEORY

SEMESTER II**Chemistry-I**

COURSE CODE	TITLE	CREDITS
SBT 201	Bioorganic Chemistry	2
Unit I Biomolecules: Carbohydrates and Lipids	Carbohydrates: Structure, Function, Classification, Characteristic Reactions, Physical and Chemical Properties, D & L Glycerinaldehydes, structure of Monosaccharide, Disaccharides, and Polysaccharides. Isomers of Monosaccharides, Chemical/Physical Properties of Carbohydrate, Chemical Reactions for Detection of Mono., Di and Polysaccharides, Lipids: Classification of Lipids, Properties of Saturated, Unsaturated Fatty Acids, Rancidity, and Hydrogenation of Oils Phospholipids: Lecithin Cephalin, Plasmalogen Triacylglycerol-Structure and Function Sterols: Cholesterol: Structure and Function , Lipoproteins: Structure and Function, Storage Lipids, Structural Lipids, Action of Phospholipases, Steroids	15 lectures
Unit II Biomolecules: Proteins and Amino Acids	Proteins and Amino Acids: Classification, Preparation and Properties, Isoelectric Point, Peptide Synthesis Proteins: Classification based on Structure and Functions, Primary Structure, N-terminal (Sanger and Edmans Method) and C-terminal Analysis (Enzyme) Reactions of Amino Acids, Sorenson' s Titration, Ninhydrin Test. Denaturation of protein Structure of Peptides. Titration Curve of Amino Acids. Concept of Isoelectric pH, Zwitter ion. Glycoproteins	15 lectures
Unit III	Nucleic Acids: Structure, Function of Nucleic Acids, Properties and Types of	15 lectures

Biomolecules: Nucleic Acids	DNA, RNA. Structure of Purine and Pyrimidine Bases Hydrogen Bonding between Nitrogenous Bases in DNA Differences between DNA and RNA, Structure of Nucleosides, Nucleotides and Polynucleotides.	
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**SEMESTER II
Chemistry-II**

COURSE CODE	TITLE	CREDITS
SBT 202	Physical Chemistry	2
Unit I Thermodynamics	Thermodynamics: System, Surrounding, Boundaries Sign Conventions, State Functions, Internal Energy and Enthalpy: Significance, examples, (Numericals expected.) Laws of Thermodynamics and its Limitations, Mathematical expression. Qualitative discussion of Carnot Cycle for ideal Gas and Mechanical Efficiency. Laws of Thermodynamics as applied to Biochemical Systems. Concept of Entropy, Entropy for Isobaric, Isochoric and Isothermal Processes.	15 lectures
Unit II Chemical Kinetics	Reaction Kinetics: Rate of Reaction, Rate Constant, Measurement of Reaction Rates Order & Molecularity of Reaction, Integrated Rate Equation of First and Second order reactions (with equal initial concentration of reactants). (Numericals expected) Determination of Order of Reaction by a) Integration Method b) Graphical Method c) Ostwald's Isolation Method d) Half Time Method. (Numericals expected).	15 lectures
Unit III Oxidation Reduction reactions	Principals of Oxidation & Reduction Reactions: Oxidising and Reducing Agents, Oxidation Number, Rules to assign Oxidation Numbers with examples Ions like	15 lectures

	Oxalate, Permanganate and Dichromate. Balancing Redox Reactions by Ion Electron Method Oxidation, Reduction, Addition and Substitution & Elimination Reactions.	
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SEMESTER II
Life Sciences-I

COURSE CODE	TITLE	CREDITS
SBT 203	Physiology and Ecology	2
Unit I Plant Physiology	Photosynthesis, Intracellular Organization of Photosynthetic System. Fundamental Reactions of Photosynthesis, Photosynthetic Pigments, Role of Light. Hill Reaction and its Significance, Light Reactions, Cyclic and Non-Cyclic Photo induced Electron Flow, Energetics of Photosynthesis, Photorespiration, Dark Phase of Photosynthesis, Calvin Cycle, C-3, C-4 pathways Introduction to Secondary Metabolites	15 lectures
Unit II Animal Physiology	Physiology of Digestion Movement of Food and Absorption, Secretary functions of Alimentary Canal, Digestion and Absorption, assimilation in Gut of Mammals Anatomy of Mammalian Kidney, Structure of Nephron, Physiology of Urine Formation and Role of Kidney in Excretion and Osmoregulation Physiology of Respiration, Mechanism of Respiration Principles of Gaseous Exchange in the Blood and Body Fluids Blood and Circulation : Blood Composition, Structure and Function of its Constituents	15 lectures

	Blood Coagulation and Anti-Coagulants Hemoglobin and its Polymorphism Regulation of the Circulation Mechanism and working of Heart in Human.	
Unit III Ecosystem and Interactions	Ecology and Biogeography. Ecosystems, Definition and Components, Structure and Function of Ecosystems. Aquatic and Terrestrial Ecosystems, Biotic and Abiotic Factors, Trophic Levels, Food Chain and Food Web, Ecological Pyramids (Energy, Biomass and Number) Nutrient Cycle and Biogeochemical Cycles: Water, Carbon, Oxygen, Nitrogen and Sulphur. Interactions, Commensalism, Mutualism, Predation and Antibiosis, Parasitism.	15 lectures

SEMESTER – II
Life Sciences-II

COURSE CODE	TITLE	CREDITS
SBT 204	Genetics	2
Unit I Genetics Fundamentals	Mendel's Laws of Heredity Monohybrid Cross: Principle of Dominance and Segregation. Dihybrid Cross: Principle of Independent Assortment. Application of Mendel's Principles Punnett Square. Mendel's Principle in Human Genetics. Incomplete Dominance and Co-dominance. Multiple Alleles. Allelic series. Variations among the effect of the Mutation. Genotype and Phenotype. Environmental effect on the expression of the Human Genes. Gene Interaction. Epistasis.	15 lectures

<p align="center">Unit II Microbial Genetics</p>	<p>Genetic analysis in Bacteria- Prototrophs, Auxotrophs. Bacteriophages: Lytic and Lysogenic Development of Phage. Mechanism of Genetic Exchange in Bacteria: Conjugation; Transformation; Transduction; (Generalized Transduction, Specialized Transduction) Bacterial Transposable Elements.</p>	<p>15 lectures</p>
<p align="center">Unit III Population Genetics</p>	<p>Genetic Structure of Populations – Genotypic Frequencies and Allelic Frequencies, Hardy- Weinberg Law and its assumptions Genetic Variations in Populations- Measuring Genetic Variation at Protein Level and measuring Genetic Variations at DNA level Natural Selection. Genetic Drift Speciation Role of Population Genetics in Conservation Biology</p>	<p>15 lectures</p>

**SEMESTER II
Biotechnology-I**

COURSE CODE	TITLE	CREDITS
<p align="center">SBT 205</p>	<p align="center">Tissue Culture & Scientific Writing and Communication Skills</p>	<p align="center">2</p>
<p align="center">Unit I Plant Tissue Culture</p>	<p>Cell Theory, Concept of Cell Culture, Cellular Totipotency, Organization of Plant Tissue Culture Laboratory : Equipments and Instruments Aseptic Techniques: Washing of Glassware, Media Sterilization, Aseptic Workstation, Precautions to maintain Aseptic Conditions.</p> <p>Culture Medium: Nutritional requirements of the explants, PGR's and their <i>in-vitro</i> roles, Media Preparation Callus Culture Technique: Introduction, Principle and Protocols</p>	<p>15 lectures</p>

<p style="text-align: center;">Unit II Animal Tissue Culture</p>	<p>Basics of Animal Tissue Culture Introduction Cell Culture Techniques, Equipment and Sterilization Methodology. Introduction to Animal Cell Cultures: Nutritional and Physiological: Growth Factors and Growth Parameters. General Metabolism and Growth Kinetics Primary Cell Cultures : Establishment and Maintenance of Primary Cell Cultures of Adherent and Non-Adherent Cell Lines with examples. Application of Cell Cultures</p>	<p>15 lectures</p>
<p style="text-align: center;">Unit III Scientific Writing and Communication Skills</p>	<p>Communication Skills Introduction to Communication -- Elements, Definitions, Scope of Communication and Communication as part of Science Communication Elements --Verbal and Non-Verbal Communications. Principles of Effective Communication, Oral Presentations Scientific Reading, Writing & Presentation Scientific Writing Process of Scientific Writing: Thinking, Planning, Rough Drafts and Revising Contents. Introduction to Scientific Reports and Writings Compilation of Experimental Data, Communication Methods in Science, Examples of Scientific and Unscientific Writing. Writing Papers, Reviews, Bibliography Plagiarism--Introduction to Plagiarism , Examples of Plagiarism.</p>	<p>15 lectures</p>

SEMESTER - II
Biotechnology-II

COURSE CODE	TITLE	CREDITS
SBT 206	Enzymology, Immunology and Biostatistics	2
Unit I Enzymes	Definition, Classification, Nomenclature, Chemical Nature, Properties of Enzymes, Mechanism of Enzyme Action, Active Sites, Enzyme Specificity, Effect of pH, Temperature, Substrate Concentration on Enzyme Activity, Enzyme Kinetics, Michelis-Menten Equation, Types of Enzyme Inhibitions-Competitive, Uncompetitive, Non-Competitive Allosteric Modulators CoFactors, Zymogens,	15 lectures
Unit II Immunology	Overview of Immune Systems, Cell and Organs involved, T and B cells. Innate Immunity, Acquired Immunity, Local and Herd Immunity, Humoral and Cellular Immunity - Factors Influencing and Mechanisms of each. Antigens and Antibodies: Types of Antigens, General Properties of Antigens, Haptens and Superantigens Discovery and Structure of Antibodies (Framework region) Classes of Immunoglobulins, Antigenic Determinants. Antigen-Antibody Interactions Monoclonal Antibodies, Vaccines (Live, Killed) and Toxoid. Problems with Traditional Vaccines, Impact of Biotechnology on Vaccine Development.	15 lectures
Unit III Biostatistics	Definition & Importance of Statistics in Biology Types of Data, Normal and Frequency Distribution Representation of Data and Graphs (Bar Diagrams, Pie Charts and Histogram, Polygon and Curve) Types of Population Sampling Measures of Central Tendency (For Raw, Ungroup & Group Data) Mean Median Mode Measures of Dispersion Range, Variance, Coefficient of Variance. Standard Derivation. Standard Error.	15 lectures

Semester – II
PRACTICALS

SEMESTER – II
Practicals
Chemistry

COURSE CODE	TITLE	CREDITS	Notional Hours
SBTP 201	Chemistry	2	30 hrs
<ol style="list-style-type: none"> 1. Spot test for Carbohydrates, Fats and Proteins and Amino Acids and Nucleic Acids 2. Standardization of Colorimeter and Estimation of Reducing sugar by DNSA method 3. Estimation of Protein by Biuret method and Lowry method 4. Saponification of Fats, Saponification Value of Oil or Fat, Iodine value of Oil and determine the rate constant for the saponification reaction between ethyl acetate and NaOH by back titration method 5. To determine enthalpy of dissolution of salt like KNO₃ 6. Determine the rate constant for hydrolysis of ester using HCl as a catalyst 7. Study the kinetics of reaction between Thiosulphate ion and HCl 8. Study reaction between potassium Persulphate and Potassium Iodide kinetically and hence to determine order of reaction 9. Study the reaction between NaHSO₃ and KMnO₄ and balancing the reaction in acidic, alkaline and neutral medium 10. Study transfer of electrons (Titration of sodium thiosulphate with potassium dichromate) 11. Determination of the volume strength of hydrogen peroxide solution by titration with standardised potassium permanganate solution 12. Determination of amount of K oxalate and oxalic acid in the given solution Titrimetrically 			

SEMESTER – II
Practicals
Life Sciences

COURSE CODE	TITLE	CREDITS	Notional Hours
USBTP 202	Life Sciences	2	30 hrs
<ol style="list-style-type: none"> 1. Study of Hill's reaction 2. Colorimetric study of Absorption Spectrum of Photosynthetic Pigments 3. Movement of Food in Paramecium- Demonstration. 4. Activity of Salivary Amylase on Starch 5. Analysis of Urine 6. Study of Mammalian Blood, Blood count using Haemocytometer and estimation of Haemoglobin in Mammalian Blood 7. Study of Human Blood Groups 8. Study of Mammalian Kidney and Heart 9. Problems in Mendelian Genetics 10. Study of Mitosis and Meiosis 11. Study of Karyotypes – Normal Male and Normal Female 12. Study of Interactions Commensalism, Mutualism, Predation and Antibiosis, Parasitism. 			

SEMESTER – II
Practicals
Biotechnology

COURSE CODE	TITLE	CREDITS	Notional Hours
SBTP 203	Biotechnology	2	30 hrs
<ol style="list-style-type: none"> 1. Working and use of various Instruments used in Biotechnology Laboratory (Autoclave, Hot air Oven, Centrifuge, Incubator, Rotary Shaker, Filter Assembly, LAF, <i>pH</i> meter and Colorimeter) 2. Laboratory Organization and Layout for Plant and Animal Tissue Culture Laboratory 3. Preparation of Stock Solutions and Preparation of Media for PTC 4. Aseptic Transfer Technique, Surface Sterilization and Inoculation for Callus Culture 5. Media Preparation and Sterilization (ATC) 6. Trypsinization of Tissue and Viability Count 7. Qualitative Assay of Enzyme Amylase. Lipase, Protease, Urease, Catalase and Dehydrogenase 8. Enzyme Kinetics : Study of the effect of <i>pH</i>, Temperature on activity of Enzyme 9. Study of Effect of Substrate Concentration on enzyme activity and determination of V_{max} and K_m 10. Study of antigen antibody interaction by Ouchterlony method 11. Biometric Analysis for Mean, Median, Mode and Standard Deviation and Data representation using frequency Polygon, Histogram and Pie Diagram 12. Preparation of review reports of 5 Scientific Papers and Presentation (last 5 years) 			

Semester – I and II

Ability Enhancement Course 1 (FC I)
Ability Enhancement Course 2 (FC II)

SEMESTER I
Ability Enhancement Course 1 (FC I)
Societal Awareness

COURSE CODE	TITLE	CREDITS
SBT 107	Societal Awareness	2
Unit I Overview of Indian Society	Understand the multi-cultural diversity of Indian society through its demographic composition: population distribution according to religion, caste, and gender; Appreciate the concept of linguistic diversity in relation to the Indian situation; Understand regional variations according to rural, urban and tribal characteristics; Understanding the concept of diversity as difference	15 Lectures
Unit II Concept of Disparity	<p>Concept of Disparity- I Understand the concept of disparity as arising out of stratification and inequality; Explore the disparities arising out of gender with special reference to violence against women, female foeticide (declining sex ratio), and portrayal of women in media; Appreciate the inequalities faced by people with disabilities and understand the issues of people with physical and mental disabilities</p> <p>Concept of Disparity-II Examine inequalities manifested due to the caste system and inter-group conflicts arising thereof; Understand inter-group conflicts arising out of communalism; Examine the causes and effects of conflicts arising out of regionalism and linguistic Differences</p>	15 Lectures
Unit III The Indian Constitution and Significant Aspects of Political Processes	<p>The Indian Constitution Philosophy of the Constitution as set out in the Preamble; The structure of the Constitution-the Preamble, Main Body and Schedules; Fundamental Duties of the Indian Citizen; tolerance, peace and communal harmony as crucial values in strengthening the social fabric of Indian society; Basic features of the Constitution</p> <p>Significant Aspects of Political Processes The party system in Indian politics; Local self-government in urban and rural areas; the 73rd and 74th Amendments and their implications for inclusive politics; Role and significance of women in politics</p>	15 lectures

SEMESTER II

Ability Enhancement Course 2 (FC II)

Globalization, Ecology and Sustainable Development

COURSE CODE	TITLE	CREDITS
SBT 207	Globalization, Ecology and Sustainable Development	2
Unit I Globalisation and Indian Society and Human Rights	<p>Globalisation and Indian Society Understanding the concepts of liberalization, privatization and globalization; Growth of information technology and communication and its impact manifested in everyday life; Impact of globalization on industry: changes in employment and increasing migration; Changes in agrarian sector due to globalization; rise in corporate farming and increase in farmers' suicides.</p> <p>Human Rights Concept of Human Rights; origin and evolution of the concept; The Universal Declaration of Human Rights; Human Rights constituents with special reference to Fundamental Rights stated in the Constitution</p>	15 Lectures
Unit II Ecology and Sustainable Development	<p>Ecology and Sustainable Development Importance of Environment Studies in the current developmental context; Understanding concepts of Environment, Ecology and their interconnectedness; Environment as natural capital and connection to quality of human life; Environmental Degradation causes and impact on human life; Sustainable development, concept and components; poverty and environment</p>	15 Lectures
Unit III Understanding and Managing Stress and Conflict in Contemporary Society	<p>Understanding Stress and Conflict Causes of stress and conflict in individuals and society; Agents of socialization and the role played by them in developing the individual; Significance of values, ethics and prejudices in developing the individual; Stereotyping and prejudice as significant factors in causing conflicts in society. Aggression and violence as the public expression of conflict</p> <p>Managing Stress and Conflict in Society Types of conflicts and use of coping mechanisms for managing individual stress; Maslow's theory of self-actualisation; Different methods of responding to conflicts in society; Conflict-resolution and efforts towards building peace and harmony in society</p>	15 lectures

Evaluation Scheme

The performance of the learners shall be evaluated into TWO Parts.

The learner's performance shall be assessed by Internal Assessment with 40 marks & by conducting the Semester End Examinations with 60 marks .

Practical Training will have Practical Examination for 50 marks at the end of Semester.

The allocation of marks for the Internal Assessment and Semester End Examinations are as follows:-

I. Internal Exam-40 Marks

(i) Test– 15 Marks

(ii) Assignments/Presentations-15 Marks

(iii) Activities - 10 Marks

II. External Examination- 60 Marks

(i) Theory Question Paper Pattern:-

All questions are compulsory.		
Question	Based on	Marks
Q.1	Unit I	15
Q.2	Unit II	15
Q.3	Unit III	15
Q.4	Unit I,II and III	15

- All questions shall be compulsory with internal choice within the questions.
- Each Question may be sub-divided into sub questions as a, b, c, d &e, etc & the allocation of Marks depends on the weightage of the topic.

III. Practical Examination – 300 marks (50 marks x 6 core papers)

Each Core Subject Carries 50 Marks

Chemistry : 30 marks + 10 marks (Journal)+ 10 marks(Viva-voce)

Life Sciences and Biotechnology : Major (20 marks), Minor (10 marks), Identification /Spots (10 marks), Viva-voce (5 marks), Journal (5 marks)

IV. Ability Enhancement Course

V. Internal Exam-40 Marks

(i)Project– 30 Marks

(ii)Activities-10 Marks

VI. External Examination- 60 Marks

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