

FYBSC Biotechnology SEMESTER I

Course Code	Name of the Course
	MAJOR:
VGVUSBMBT101	1. Biotechnology I: Introduction to Biotechnology
VGVUSBMBM101	2. Basic Microbiology: Microbial Technology
VGVUSBMP101	3. Practicals of Basic Biotechnology & Basic Microbial techniques
	OPEN ELECTIVES:
VGVUOE112	Basic Accounting and Practices
VGVUOE115	Financial Markets
VGVUOE119	History of Media
VGVUOE120	Indian Financial System
VGVUOE121	Introduction to Managerial Practices
VGVUOE122	Organizational Behaviour
VGVUOE123	The India Story
VGVUOE124	Visual Communication
	VOCATIONAL & SKILL ENHANCEMENT COURSE
VGVUSBVSE101	1. Bioorganic Chemistry I
VGVUSBVSEP101	2. Practicals of Bioorganic Chemistry I
	ABILITY ENHANCEMENT COURSE
VGVUFAE103	Effective Communication Skills
	VALUE EDUCATION COURSE
VGVUVE104	The Constitution of India.
	INDIAN KNOWLEDGE SYSTEM
VGVUIKS107	History of Biotechnology.
	CO-CURRICULAR COURSES
VGVUCC101	1. Community Engagement Activities
VGVUCC102	2. Cultural Activities
VGVUCC103	3. National Service Scheme (NSS)
VGVUCC104	4. Sports Activities
VGVUCC105	5. Yoga

FYBSC Biotechnology SEMESTER II

Course Code	Name of the Course
	MAJOR:
VGVUSBMBT201	1. Biotechnology II: Genetics and Molecular Biology
VGVUSBMLS201	2. Basic Life Science: Biodiversity and Cell Biology
VGVUSBMP201	3. Practicals of Biotechnology II & Basic Life Science
	MINOR:
VGVUSBNAPI201	ATC, PTC & Immunology
	OPEN ELECTIVES:
VGVUOE212	Basic Accounting and Practices
VGVUOE215	Financial Markets
VGVUOE219	History of Media
VGVUOE220	Indian Financial System
VGVUOE221	Introduction to Managerial Practices
VGVUOE222	Organizational Behaviour
VGVUOE223	The India Story
VGVUOE224	Visual Communication
	VOCATIONAL & SKILL ENHANCEMENT COURSE
VGVUSBVSE201	Bioorganic Chemistry II
VGVUSBVSEP201	Practicals of Bioorganic Chemistry II
	ABILITY ENHANCEMENT COURSE
VGVUFAE203	Biostatistics
	VALUE EDUCATION COURSE
VGVUVE204	Human Rights.
	CO-CURRICULAR COURSES
VGVUCC201	Community Engagement Activities
VGVUCC202	Cultural Activities
VGVUCC203	National Service Scheme (NSS)
VGVUCC204	Sports Activities
VGVUCC205	Yoga

SEMESTER I

B. Sc. (Biotechnology)		Semester – I	
Course Name: Biotechnology I: Introduction to Biotechnology		Course Code: VGVUSBMBT101	
Periods per week (1 Period is 60 minutes)		2	
Credits		2	
		Hours	Marks
Evaluation System	Theory Examination	2	60
	Internal	--	40
<p>Course Objectives</p> <p>To acquaint students with various fields of Biotechnology and their applications. To impart the knowledge of food technology and fermentation techniques</p>			
I Scope and Introduction to Biotechnology	Definition of Biotechnology. Branches of Biotechnology- Plant, Animal, Marine, Agriculture, Healthcare, Industrial, Pharmaceutical and Environmental Biotechnology.		10 LEC
II Applications Biotechnology	GM Food: GM Papaya, GM Tomato, Golden Rice. Molecular Pharming, Plant based vaccines. Fungal and Insect Resistant Plants - BT Cotton and BT Brinjal. Biotechnological applications in Crop and Livestock. Ethics in Biotechnology and IPR		10 LEC
III Food and Fermentation Biotechnology	Biotechnological applications for enhancement of Food Quality. Role of microbes in food products: Yeast, Bacterial and other Microorganisms based process and products. Modern Biotechnological Regulatory Aspects in Food Industries. Biotechnology and Food - Social Appraisal Microbial Fermentations Overview of Industrial Production of Chemicals (Acetic Acid, Citric Acid and Ethanol), Antibiotics, Enzymes and Beverages		10 LEC

Course Outcome**Learners should be able to****CO1** Understand the scope of Biotechnology.**CO2** Understand various applications of Biotechnology.**Books and References:**

Sr. No.	Title	Author/s	Publisher
1.	Textbook of Biotechnology	R.C.Dubey	S.Chand
2.	Biotechnology	H.K.Das	Himalaya
3	Advances in Biotechnology	S.N. Jogdand	Himalaya

B. Sc (Biotechnology)		Semester – I	
Course Name: Basic Microbiology: Microbial Technology		Course Code: VGVUSBMBM101	
Periods per week (1 Period is 60 minutes)		2	
Credits		2	
		Hours	Marks
Evaluation System	Theory Examination	2	60
	Internal	--	40
Course Objectives			
To acquaint students with various aspects of Microbiology and their applications. To impart the knowledge of microbial diversity and Mendelian genetics.			
Unit	Details	Lectures	
Unit I	Introduction to Microbial Diversity: Archaeobacteria, Eubacteria, Cyanobacteria, Actinomycetes, Fungi, Eumycota Bacteria: Classification, Types, Morphology (Size, Shape and Arrangement) Modes of cell division Ultrastructure of Prokaryotic Cell: Concept of Cell Shape and Size, Detail Structure of Slime Layer, Capsule, Flagella, Pilli, Cell Wall (Gram Positive and Negative), Cell Membrane, Protoplast and Spheroplast, Cytoplasm and Genetic Material Storage Bodies and Spores	10 LEC	
Unit II	Enumeration of Microorganisms: Direct and Indirect Methods: Direct microscopic count – Breed’s count, Petroff -Hausser counting chamber, Haemocytometer. Viable count – Spread plate and Pour plate technique. Turbidity measurements – Nephelometer and spectrophotometer techniques Growth curve: Phases of growth, generation time, growth rate Sterilization and Disinfection: Definition, Sterilization of media and glass wares; Types and Applications- Dry Heat, Steam under pressure, Gases, Radiation and Filtration; Chemical Agents and their Mode of Action- Aldehydes, Halogens, Phenol, Alcohol, and Detergents; Ideal Disinfectant Properties, and Evaluation of Disinfectant	10 LEC	
Unit III	Mendel’s Laws of Heredity Monohybrid Cross: Principle of Dominance and Segregation. Dihybrid Cross: Principle of Independent Assortment. Application of Mendel’s Principles	10 LEC	

	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 In Epistasis.	
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Course Outcomes	Learners should be able to
CO1	Understand the scope of Microbiology.
CO2	Understand various aspects of Microbiology.

B. Sc. (Biotechnology)		Semester – I	
Course Name: Basic Biotechnology & Basic Microbial techniques Practical		Course Code: VGVUSBMP101	
Periods per week (1 Period is 120 minutes)		2	
Credits		2	
		Hours	Marks
Evaluation System	Practical Examination	4	100
	Internal	--	--
List of Practicals Basic Biotechnology			
<ol style="list-style-type: none"> 1. Assignment- Study of any branch of biotechnology and its applications 2. Microbial examination of food and detection of Pathogenic Bacteria from Food Samples 3. Microscopic determination of Microbial flora from Yoghurt and Lactic Acid Determination 4. Analysis of Milk- Methylene Blue, Resazurin Test, Phosphatase Test 5. Extraction of Caesin from Milk 6. Meat Tenderization using Papain 7. Fermentative production of Alcohol. 8. Determination of Alcohol content. 9. Isolation and purification of DNA (genomic). 			
List of Practicals -Basic Microbial techniques			
<ol style="list-style-type: none"> 1. Monochrome Staining, Differential Staining, Gram Staining, Acid Fast Staining and Romonowsky Staining 2. Sterilization of Laboratory Glassware and Media using Autoclave 3. Preparation of Media- Nutrient broth and Agar, MacConkey Agar, Saborauds Agar 4. Isolation of Organisms: T-streak, Polygon method 5. Colony Characteristics of Microorganisms, 6. Aseptic transfer 7. Enumeration by Breed's count 8. Growth Curve of <i>E.coli</i> 9. Problems in Mendelian Genetics 			

B. Sc. (Biotechnology)		Semester – I	
Course Name: Bioorganic Chemistry I		Course Code: VGVUSBVSE101	
Periods per week (1 Period is 60 minutes)		2	
Credits		2	
		Hours	Marks
Evaluation System	Theory Examination	2	60
	Internal	--	40

Course Objectives

To acquaint students with various aspects of Bioorganic Chemistry.
To impart the knowledge of biomolecules.

Unit	Details	Lectures
I	Carbohydrates Structure, Function, Classification. Characteristic Reactions, Physical and Chemical Properties, D & L-Glyceraldehyde, Structure of Monosaccharide, Disaccharides, and Polysaccharides(3L) Isomers of Monosaccharides, Mutarotation Concept of Epimers, anomers.(3L) Chemical/Physical Properties of Carbohydrate Chemical Reactions for Detection of Mono-, Di- and Polysaccharides (3L) Structural and functional polysaccharides-examples (2L) Glycoproteins and proteoglycans-examples(1L)	10
II	Nucleic Acids: Structure of Purine and Pyrimidine Bases, Structure of Nucleosides, Nucleotides and Polynucleotides DNA and RNA: Structure, types, and function of DNA and RNA (4L) Properties of DNA and RNA - Hydrogen Bonding between Nitrogenous Bases in DNA, Differences between DNA and RNA, cDNA, Denaturation, Annealing, T _m , Hypo & hyperchromic effect. Chemical synthesis of DNA and DNA hybridization (2L)	10

III	Lipids: Classification of Lipids, Concept of Storage Lipids and Structural Lipids Properties of Saturated, Unsaturated Fatty Acids, Rancidity, and Hydrogenation of Oils (4L) Triacylglycerol, Phospholipids, Sphingolipids, Sterols: Basic structure, function, and examples (3L) Lipoproteins- Structure and Function (1L) Use of Lipids as cofactors, signals and pigments (2L) Methods involved in the Extraction, separation and identification of cellular lipids (2L)	10
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Course Outcomes	Learners should be able to
CO1	Understand the structure and function of various biomolecules.
CO2	Understand various aspects Bioorganic Chemistry.

B. Sc. (Biotechnology)		Semester – I	
Course Name: Bioorganic Chemistry I		Course Code: VGVUSBVSEP101	
Periods per week (1 Period is 120 minutes)		2	
Credits		2	
		Hours	Marks
Evaluation System	Practical Examination	4	100
	Internal	--	--
List of Practicals Bioorganic Chemistry			
<ol style="list-style-type: none"> 1. Spot test for Carbohydrates (Benedict, Anthrone and Molisch), 2. Spot test for Fats. 3. Spot test for Nucleic acids. 4. Paper Chromatography of carbohydrates & amino acids. 5. Estimation of reducing sugar by DNSA method. 6. Estimation of protein by Biuret method and Lowry method 7. Estimation of DNA by DPA method. 8. Estimation of RNA by Orcinol method. 9. Saponification of Fats: Saponification Value of Oil or Fat. 10. Iodine value of Oil. 11. Determination of rate constant for the saponification reaction between ethyl acetate and NaOH by back titration method. 			

B. Sc (Biotechnology)		Semester – I	
Course Name: Effective Communication Skills		Course Code: VGVUFAE103	
Periods per week (1 Period is 60 minutes)		2	
Credits		2	
		Hours	Marks
Evaluation System	Theory Examination	2	60
	Internal		40

Course Objective

To make learner understand

1. Recognized seven C's of communication.
2. Importance of nonverbal communication.
3. Oral, written communication skills.
4. Appreciated role of body language and voice tone in effective communication.
5. Communicate the message in businesses in an effective and engaging way

Unit	Details	Lectures
I	The Seven Cs of Effective Communication: Completeness, Conciseness, Consideration, Concreteness, Clarity, Courtesy, Correctness. Understanding Business Communication: Nature and Scope of Communication, Non-verbal Communication.	10
II	Writing Business Messages and Documents: Business writing, Business Correspondence, Instructions, Career building and Resume writing. Developing Oral Communication Skills or Business: Effective Listening, Business Presentations and Public Speaking, Conversations, Interviews	10
III	Developing Oral Communication Skills or Business: Meetings, Group Discussions and Team Presentations and team Briefing, Understanding Specific Communication Needs: Corporate Communication, Persuasive Strategies in Business Communication,	10

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Business Communication	Edited by Meenakshi Raman and Prakash Singh	Oxford University Press	Second	
2.	Professional Communication	Aruna Koneru	Tata McGraw Hill		
3.	Strategies for improving your business communication	Pro. M. S. Rao	Shroff publishers and distributors		2016
4.	Business Communication	Dr. Rishipal and Dr. Jyoti Sheoran	SPD		2014

Course Outcome**Learners should be able to****CO1** Communicate effectively.**CO2** Will be able to improve understanding and build rapport with others.**CO3** Communicate in a group**CO4** Prepare and deliver presentation effectively.**CO5** Prepare Writing Business Messages and Documents.

B. Sc (Biotechnology)		Semester – I	
Course Name: The Constitution of India.		Course Code: VGVUVE104	
Periods per week (1 Period is 60 minutes)		2	
Credits		2	
		Hours	Marks
Evaluation System	Theory Examination	2	60
	Internal		40

Course Objectives:

1. To examine the structure and features of the Indian Constitution.
2. To review the Party System in India.
3. To understand and analyze the role of women in Indian politics.

Unit	Details	Lectures
I: The Indian Constitution	a) The structure of the Constitution and the Preamble. b) Fundamental Duties of the Indian Citizen; tolerance, peace and communal harmony. c) Features of Indian Constitution	15
II: Significant Aspects of Political Processes	a) The party system in Indian politics	15

	<p>b) Local self -government in rural and urban areas.</p> <p>c) Role and significance of women in politics.</p>	
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Course Outcomes:

Students should be able to:

CO1

Acquire basic knowledge of the features, structure of the Indian Constitution, the Fundamental Duties of the citizens, and political processes in India.

Recommended Resources:

Reference Books

In English

M. Laxmikanth, *Indian Polity*, Tata McGraw Hill, New Delhi, 2013.

Durga Das Basu, *An Introduction to the Constitution of India*, Prentice

Hall, 1982

P.M.Bakshi, *Constitution of India*, Universal Law Publishing , 2010

Jhabwalla, Noshirvan H, *The Constitution of*

	<i>India, c. Jamnadas & Co., 2004.</i>
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B. Sc (Biotechnology)		Semester – I	
Course Name: History of Biotechnology		Course Code: VGVUIKS107	
Periods per week (1 Period is 60 minutes)		2	
Credits		2	
		Hours	Marks
Evaluation System	Theory Examination	02	60
	Internal		40

Course Objectives

To acquaint students with historical aspects of Biotechnology.
To impart the knowledge of evolution and diversification of Biotechnology.

Unit	Details	Lectures
I	Advent of Biotechnology, Traditional and Modern Biotechnology- Tracing biotechnology through ages, Biotechnology in Healthcare, Public perception of Biotechnology,	10
II	Ethics in Biotechnology. Biotechnological Research in India, Biotechnology Institutions in India (Public and Private sector), Consumption of Biotech products, Biotech policy initiatives, Biotechnology in context of developing World	10
III	Biotech success stories in India, Biotechnology in India- Bio-business (Biotechnology market) in India, Ethical issues in Biotechnology in India.	10

Course Outcomes	Learners should be able to
CO1	Understand the historical aspects of Biotechnology.
CO2	Understand evolution of Biotechnology.

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition
1.	Textbook of Biotechnology	R.C.Dubey	S.Chand	4th
2.	Biotechnology	H.K.Das	Himalaya	3rd
3	Advances in Biotechnology	S.N. Jogdand	Himalaya	6th

SEMESTER II

B. Sc. (Biotechnology)		Semester – II	
Course Name: Biotechnology II: Genetics and Molecular Biology		Course Code: VGVUSBMBT201	
Periods per week (1 Period is 60 minutes)		2	
Credits		2	
		Hours	Marks
Evaluation System	Theory Examination	2	60
	Internal	--	40

Course Objectives

To acquaint students with various aspects of Biotechnology.
To impart the knowledge of population genetics and basic molecular processes in biology.

Unit	Details	Lectures
I	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, End replication problem, Action of Telomerase Recombinant DNA technology: Genetic Engineering in E.coli, Cloning Vector - Plasmid, Enzymes - DNA Polymerases, Restriction Endonucleases, Ligases, Reverse Transcriptases, Nucleases, Terminal Transferases, Phosphatases	10
II	Mutations: Definition and Types of Mutations, Mutagens (Examples of Physical, Chemical and Biological Mutagens) Types of Point Mutations, DNA repair – Photo reversal, Base Excision Repair, Nucleotide Excision Repair, Mismatch Repair, SOS Repair Genetic analysis in Bacteria & Bacteriophages: Prototrophs, Auxotroph Mechanism of Genetic Exchange in Bacteria-Conjugation; Transformation; Transduction (Bacteriophages – Lytic and Lysogenic cycle).	10
III	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	10

Course Outcomes	Learners should be able to
CO1	Understand basics of population genetics.
CO2	Understand genetics of bacteria and bacteriophages.
CO3	Understand DNA replication in prokaryotes and eukaryotes.
CO4	Understand basics of recombinant DNA technology and mutagenesis.

Book					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	iGenetics-A Molecular Approach	Peter Russell	Pearson	3rd	2005

B. Sc. (Biotechnology)		Semester – II	
Course Name: Basic Life Science: Biodiversity and Cell Biology		Course Code: VGVUSBMLS201	
Periods per week (1 Period is 60 minutes)		2	
Credits		2	
		Hours	Marks
Evaluation System	Theory Examination	2	60
	Internal	--	40

Course Objectives

To acquaint students with various aspects of Life Sciences.
 To impart the knowledge of biodiversity, ultrastructure of eukaryotic cell, plant physiology and animal physiology

Unit	Details	Lectures
I	<p>Origin of Life, Chemical and Biological Evolution, Origin of Eukaryotic Cell. 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>	10
II	<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 Eukaryotic Ribosomes, Mitochondria and Chloroplasts Nucleus –Nuclear Structure, Nucleolus External Cell Coverings: Cilia and Flagella Comparison of Prokaryotic and Eukaryotic Cells</p>	10
III	<p>Plant Physiology: Photosynthesis, Intracellular Organization of Photosynthetic System, Photosynthetic Pigments, Fundamental Reactions of Photosynthesis. Role of Light. Hill's 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-4 and CAM pathway.</p> <p>Animal Physiology: Physiology of Digestion, Movement of Food and Absorption, Secretory functions of Alimentary Canal, Digestion and Absorption, assimilation in Gut of Mammals.</p> <p>Anatomy of Mammalian Kidney, Structure of Nephron, Physiology of Urine Formation and Role of Kidney in Excretion and Osmoregulation</p> <p>Physiology of Respiration, Mechanism of Respiration, Principles of Gaseous Exchange in the Blood and Body Fluids</p> <p>Blood and Circulation: Blood Composition, Structure and Function of its Constituents, Blood Coagulation and Anti- Coagulants, Haemoglobin and its Polymorphism Regulation of the Circulation</p> <p>Mechanism and working of Heart in Human.</p>	10

Course Outcomes	Learners should be able to
CO1	Understand biodiversity.
CO2	Understand ultrastructure of eukaryotic cell.
CO3	Understand plant physiology.
CO4	Understand animal physiology.

B. Sc. (Biotechnology)		Semester – II	
Course Name: Practicals of Biotechnology II & Basic Life Science		Course Code: VGVUSBMP201	
Periods per week (1 Period is 120 minutes)		2	
Credits		2	
		Hours	Marks
Evaluation System	Practical Examination	4	100
	Internal	--	--

List of Practicals:

1. Study of Hill's reaction.
2. Colorimetric study of Absorption Spectrum of Photosynthetic Pigments.
3. Movement of Food in Paramecium- Demonstration.
4. Analysis of Urine.
5. Study of Mammalian Blood-Differential count.
6. Blood count using Haemocytometer.
7. Estimation of Haemoglobin in Mammalian Blood.
8. Study of Human Blood Groups.
9. Study of Mammalian Kidney and Heart.
10. Problems in Mendelian Genetics
11. Study of Mitosis and Meiosis.
12. Study of Karyotypes – Normal Male and Normal Female.
13. Study of Interactions Commensalism, Mutualism, Predation and Antibiosis, Parasitism.
14. Staining of Plant and Animal Tissues using Single and Double Staining Techniques
15. Study of Plant, Animal and Microbial Groups with at least one examples from each
16. Study of Photomicrographs of Cell Organelles

B. Sc (Biotechnology)	Semester – II
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Course Name: ATC, PTC & Immunology		Course Code: VGVUSBNAPI201	
Periods per week (1 Period is 60 minutes)		2	
Credits		2	
		Hours	Marks
Evaluation System	Theory Examination	2	60
	Internal	--	40

Course Objectives

To acquaint students with various aspects of applications of Biotechnology.
To impart the knowledge of animal tissue culture, plant tissue culture, and immunology.

Course Outcomes	Learners should be able to
CO1	Gain an overview of immunology.
CO2	Understand basic plant tissue culture techniques.
CO3	Understand basic animal tissue culture techniques.

Unit	Details	Lectures
I	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. Production of -Insulin; recombinant vaccine for Hepatitis B virus. Molecular farming, Edible vaccines and their advantages	10
II	Basics of Plant Tissue Culture: Cell Theory, Cellular Totipotency, Concept of Cell Culture, Design of PTC lab with equipment, Plant tissue culture media and phytohormones. Applications of PTC - Clonal and micro-propagation, callus culture, development of synthetic seeds and GMO	10
III	Basics of Animal Tissue Culture: Introduction to Animal Cell Culture; Terminologies - Primary cell culture,	10

Passaging, Confluency, Cell line, Organ culture; Equipments - CO2 Incubator, Laminar-Air flow, Inverted microscope, Medium filtration devices, Cell counters, liquid-nitrogen-storage tanks; Design of ATC laboratory; Applications of ATC - Cell lines for vaccine production, therapeutic proteins, pharmaceutical agents, and anticancer agents
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Course Outcomes	Learners should be able to
CO1	Gain an overview of immunology.
CO2	Understand basic plant tissue culture techniques.
CO3	Understand basic animal tissue culture techniques.

B. Sc (Biotechnology)		Semester – II	
Course Name: Bioorganic Chemistry II		Course Code: VGVUSBVSE201	
Periods per week (1 Period is 60 minutes)		2	
Credits		2	
		Hours	Marks
Evaluation System	Theory Examination	2	60
	Internal	--	40

Course Objectives

To acquaint students with various aspects of Bioorganic Chemistry.
To impart the knowledge of buffers, Proteins and basics of enzymology.

Unit	Details	Lectures
I	Water, Solutions and Buffers 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, Water as a Medium for Life (2L) Solutions: Normality, Molarity, Molality, Mole fraction, Mole concept, Solubility, Weight ratio, Volume ratio, Weight to Volume ratio, ppb, ppm, millimoles, milliequivalents (Numericals expected). (3L) Primary and Secondary Standards: Preparation of Standard Solutions, Principle of Volumetric Analysis. (1L) Acids and Bases: Lowry-Bronsted and Lewis Concepts. Strong and Weak Acids and Bases - Ionic Product of Water - pH, pKa, pKb. Hydrolysis of Salts. (3L) Buffer solutions: Concept of Buffers, Types of Buffers, Derivation of Henderson equation for Acidic and Basic buffers, Buffer action, Buffer capacity, pH of Buffer Solution. (3L)	10

II	Proteins and amino acids Amino Acids: Classification, Preparation and Properties, (3L) Isoelectric Point, Titration Curve of Amino Acids, Concept of Isoelectric pH, Zwitter-ion, Structure of Peptides, Peptide Synthesis (3L) Proteins: Classification based on Structure and Functions,(2L) Primary Structure, N-terminal (Sanger and Edmans Method) and C-terminal Analysis (Enzyme) (2L) Reactions of Amino Acids, Sorenson's Titration, Ninhydrin Test, Denaturation of protein, Glycoproteins	10
III	Enzymes Definition, Classification, Nomenclature, Chemical (1L) Nature and Properties of Enzymes, Co- Factors, Zymogens, Active Sites, Enzyme Specificity (3L) Mechanism of Enzyme Action (1L) Effect of pH, Temperature and Substrate Concentration on Enzyme Activity (2L) Enzyme Kinetics, Michaelis - Menten Equation (2L) Types of Enzyme Inhibitions - Competitive, Uncompetitive, Non-Competitive Allosteric, Modulators	10

Course Outcomes	Learners should be able to
CO1	Understand the chemistry of water and buffers.
CO2	Understand structure and function of proteins.
CO3	Understand basics of enzymology.

B. Sc (Biotechnology)		Semester – II	
Course Name: Practicals of Bioorganic Chemistry II		Course Code: VGVUSBVSEP201	
Periods per week (1 Period is 120 minutes)		2	
Credits		2	
		Hours	Marks
Evaluation System	Practical Examination	2	100
	Internal	--	--

List of Practical

1. Preparation of Standard (Molar, Molal and Normal solutions) and Buffer Solutions.
2. Determination of strength of HCl in commercial sample.
3. Determination of amount of NaHCO₃ + Na₂CO₃ in the given solid mixture titrimetrically.

4. Separation of amino acids by paper chromatography.
5. Estimation of Protein by Biuret method.
6. Estimation of Protein by Lowry method.
7. Meat Tenderization using Papain
8. Activity of Salivary Amylase on Starch
9. Qualitative Assay of Enzyme Amylase, Invertase, Urease, Lipase, Catalase and Dehydrogenase.
10. Enzyme Kinetics Vmax Km determination.
11. Study of the effect of pH, Temperature on activity of Enzyme.

B. Sc (Biotechnology)		Semester – II	
Course Name: Biostatistics		Course Code:	
Periods per week (1 Period is 60 minutes)		2	
Credits		2	
		Hours	Marks
Evaluation System	Theory Examination	2	60
	Internal	--	40

Course Objectives

Learning the basic concepts of Biostatistics.

Unit	Details	Lectures
I	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	10
II	Types of Population Sampling Measures of Central Tendency (For Raw, Ungroup & Group Data) Mean, Median, Mode, Standard Deviation. Measures of Dispersion.	10
III	Coefficient of correlation, Regression analysis, chi square, hypothesis testing, Z-test, t-test.	10

Learning Outcomes

Apply statistical formulae to analyse biological data.

B. Sc (Biotechnology)		Semester – II	
Course Name: Human Rights		Course Code: VGVUVE204	
Periods per week (1 Period is 60 minutes)		2	
Credits		2	
		Hours	Marks
Evaluation System	Theory Examination	2	60
	Internal		40

Course Objectives:

1.	1. To explain the concept of Human Rights, trace its evolution and study the work of human rights activists.
2.	1. To acquire knowledge of the violation of human rights of Vulnerable groups and the redressal mechanisms available to them.
3.	Develop knowledge of rights of citizens and the acts related to them.

UNITS	MODULES	LECTURES
I: Human Rights	<p>a) Concept and Characteristics of Human Rights; Role of Thinkers in Evolution of Human Rights; Landmark Events in Evolution of the Human Rights.</p> <p>b) Universal Declaration of Human Rights; Fundamental Rights in the Indian Constitution.</p> <p>c) Human Rights Champions: (M.K. Gandhi, MartinLuther King, Nelson Mandela, Periyar Ramasamy, Dr. B.R. Ambedkar)</p>	15
II: Human Rights Violation and Redressal	<p>a) Vulnerable Groups; Scheduled castes & Scheduled Tribes: Forms of violation and redressal mechanisms;Constitutional and legal rights</p> <p>b) Women and Children: Forms of violations and redressal mechanisms; Constitutional and legal rights</p> <p>c) People with Disabilities, Minorities, and the Elderly population: Forms of violations and redressal mechanisms; Constitutional and legal rights.</p>	15
Total No. of Lectures		30

Course Outcomes:

Students should be able to:

CO1	Comprehend fully the problems of the vulnerable groups and the redressal mechanisms available for them.
CO2	Comprehend the rights available to citizens and the role of Right to Information and Public Interest Litigation in better governance.
CO3	Describe the concept of human rights, assess the role of philosophers and explain the landmark events in the evolution of human rights.
CO4	Disseminate knowledge about evolution of human rights, comprehend and express lessons learned in the form of answers, apply the information acquired in assignments and presentations, examine critically what they have learned, establish a connect with present situations and be in a position to evaluate the value of information acquired.

Recommended Resources:

Reference Books In English	<p>Bajpai, A., Child Rights in India; Oxford University Press; New Delhi; 2003</p> <p>Chatterji, C. & Sheoran, Gunjan, Health and Human Rights: Vulnerable Groups in India, CEHAT, Mumbai, May 2007.</p> <p>Donnelly, Jack, Universal Human Rights in Theory and Practice, Cornell University Press, Ithaca, April 13, 2013, 3rd edition, ISBN-10 0801450950</p> <p>Kaushal, R., Women & Human Rights in India; Kaveri Books, New Delhi, 2000.</p>
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Rajawat, M., Human Rights and Dalits, Anmol Publications, New Delhi, 2005

Rao, B.V., History of the Modern World- from AD 1500 to AD 2013, Sterling

Publishers Pvt. Ltd., 2014, ISBN 9788120777767, 9788120777767

Shivananda, J. Human Rights, Alfa Publications, New Delhi, 2006.

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B. Sc (Biotechnology)		BT OE1	
Course Name: Food and Nutrition		Course Code: VGVUOE116	
Periods per week (1 Period is 60 minutes)		2 Lectures + 2 Practicals	
Credits		4 Total	
		Hours	Marks
Evaluation System	Theory Examination	2	60

Course Objective

Demonstrate the interaction between food nutrition and human health.

Define social, cultural and environmental influences on food access and dietary choices.

Unit	Details	Lectures
I	Introduction to the Study of Nutrition: Foods, Nutrition and Health, Digestion, Absorption and Utilization of nutrients, the Recommended Dietary Allowances for Nutrients The Nutrients and Energy: Carbohydrates, Fats and Other Lipids, Proteins and Amino Acids, Fat-soluble Vitamins, Water-Soluble Vitamins, Major and Trace Minerals, Water, Fluids, Electrolytes and Acid-base Balance.	10
II	Meal Planning and Management: Food Guides for Selecting an Adequate Diet, Meal Planning for the Family, Meal Planning for Various Age Groups, Indian Meal Patterns—Vegetarian & Non-Vegetarian, Nutrition for Fitness, Athletics and Sports, Disorders of Nutrition, Food Preparation, Food Sanitation and Hygiene, Nutrition for Fitness, Athletics and Sports, Disorders of Nutrition.	10

III	Diet Therapy: Principles of Diet Therapy and Therapeutic Nutrition, Nutrition in Infections and Diseases with examples, Nutrition in Diabetes Mellitus, Nutrition in Cardiovascular Diseases, Diet and Nutrition in Kidney Diseases, Nutrition Support in Metabolic Disorders, Nutrition in Stress, Adaptation of Normal Diet for Changing Needs.	10
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Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Fundamentals of food, nutrition & diet therapy	Sumati Mudambi, M V Rajagopal	New Age International	6th	2020
2.	Food Science	B Srilakshmi	New Age International	7th	2018

Course Outcome	
At the end of this course, learner should be able to	
CO 1	Describe multiple food systems.
CO 2	Apply the knowledge of food and nutrition to real -world situations.

B. Sc (Biotechnology)			
Course Name: Food and Nutrition Practical		Course Code: VGVUOE116	
Periods per week (1 Period is 120 minutes)		4	
Credits		2	
		Hours	Marks
Evaluation System	Practical Examination	2	40
	Internal	--	--

List of Practical	
1.	Qualitative tests for carbohydrates.
2.	Qualitative tests for proteins.
3.	Qualitative tests for lipids.
4.	Qualitative tests for aminoacids.
5.	Detection of food adulterants.
6.	Microscopic observation of curd microflora.
7.	Extraction of casein from milk.
8.	Natural food preservation methods.

B. Sc (Biotechnology)		BT OE2	
Course Name: Environmental Biotechnology		Course Code: VGVUOE114	
Periods per week (1 Period is 60 minutes)		2 Lectures + 2 Practicals	
Credits		4 Total	
		Hours	Marks
Evaluation System	Theory Examination	2	60

Course Objective

Gain awareness about different types of environmental pollution and related issues.

Unit	Details	Lectures
I	Sources of Pollution. Air Pollution : Types; Sources; Classification of Air Pollutants; Air Pollution Monitoring and Control. Water Pollution : Causes, Types and Classification; Eutrophication; Assessment of Water Quality- Pollutant Monitoring and Control;	10
II	Soil and Solid Waste : Characteristics of Wastes, Impacts of Solid Waste on Health, Occupational Hazards and Control. Soil Erosion : Concept, Causes and Effects. Concept of Bioremediation. Microorganisms in Bioremediation, Myco- remediation and Phytoremediation. Bioremediation Technologies	10

III	Green House Effect : Factors Responsible for Green House Effect; Green House Gases. Global Warming; Ozone Depletion; Kyoto Protocol; UV Radiation; Acid Rain.	10
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Course Outcome

CO1 Gain an understanding of the causes, types and control methods for environmental pollution.

CO2 Apply different life forms in environmental remediation.

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Environmental Biotechnology	M.H.Fulekar	Oxford & IBH publishers	2nd	2010
2.	Environmental Biotechnology	Indushekhar Thakur	IK International	2nd	2011

B. Sc (Biotechnology)		Semester – II	
Course Name: Practical		Course Code: VGVUOE114	
Periods per week (1 Period is 120 minutes)		4	
Credits		2	
		Hours	Marks
Evaluation System	Practical Examination	2	40
	Internal	--	--

List of Practical

1.	Estimation of TSS from water.
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2.	Estimation of TDS from water.
3.	Estimation of BOD.
4.	Estimation of COD.
5.	Study of air microflora.
6.	MPN of water sample.
7.	Rainwater harvesting (demo visit).
8.	Study of effect of pollutants on plants.

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EXAMINATION PATTERN AND MARKING SCHEME FOR B.Sc/BT SEMESTER-1

Exam	Major		Minor	OE	VSE	AEC, VE, IKS	CC
	Mandatory	Elective					
Credits	2T+2 T + 2PCredit	--		4 Credit	2 T + 2P	2 +2 +2 credits	2 credit
Internal	40 marks Class Test (15M) Assignment /Presentation 15M APICID &Attendance (10M)			40 marks Class Test (15M) Assignment /Presentation (15M) APICID & Attendance (10M)	40 marks Class Test (15M) Assignment /Presentation (15M) APICID & Attendance (10M)	50 marks Class Test (15M) Assignment /Presentation 25M APICID & Attendance (10M)	50 marks Class Test 15M Activities 35 M
External	60 marks 2 hours			60 marks 2 hours	60 marks 2 hours	---	----
For Practical courses	3Hours 2 Credit (100 M)		----		2 Credit (100 M)	----	-----
Passing Standard	Combined passing 40% marks (40/100) subject to minimum 20% in Internal (8/40) and External evaluation(12/60)			Combined passing 40% marks (40/100) subject to minimum 20% in Internal (8/40) and External evaluation12/60	Combined passing 40% marks (40/100) subject to minimum 20% in Internal (8/40) and External evaluation 12/60	Minimum passing 40% marks (20/50)	Minimum passing 40% marks (20/50)
Total	100M + 100M +100M			100M	100M+100M	50 M +50 M +50 M	50 M
					Credits 22	Grand Total= 800	

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EXAMINATION PATTERN AND MARKING SCHEME FOR B.Sc/BT SEMESTER-2

Exam	Major		Minor	OE	VSE	AEC, VEC,	CC
	Mandatory	Ele					
Credits	2T +2 T + 2PCredit	--	2 Credit	4 credits	4 Credit	2 +2 credits	2 credits
Internal	40 marks Class Test (15M) Assignment /Presentation 15M APICID &Attendance (10M)		40 marks Class test 15M Assignment /Presentation 15M APICID & Attendance 10M	40 marks Class Test 15M Assignment /Presentation 15M APICID &Attendance 10M	40 marks Class Test 15 M Assignment /Presentation 15M APICID & Attendance 10M	50 marks Class Test 15M Assignment /Presentation 25M APICID & Attendance 10M	50 marks Class Test 15M Activities 35 M
External	60 marks 2 hours		60 marks 2 hours	60 marks 2 hours	60 marks 2 hours	---	----
For Practical courses	3Hours 2 Credit (100 M)		----	3Hours 2 Credit (100 M)	2 Credit (100 M)	----	-----
Passing Standard	Combined passing 40% marks (40/100) subject to minimum 20% in Internal (8/40) and External evaluation(12/60)		Combined passing 40% marks (40/100) subject to minimum 20% in Internal (8/40) and External evaluation(12/60)	Combined passing 40% marks (40/100) subject to minimum 20% in Internal (8/40) and External evaluation(12/60)	Combined passing 40% marks (40/100) subject to minimum 20% in Internal (8/40) and External evaluation 12/60	Minimum passing 40% marks (20/50)	Minimum passing 40% marks (20/50)
Total	100 M + 100 M +100 M		100 M	100 M	100 M .100 M	50 M 50 M	50 M
				Total Credits 22	Grand Total 850		