

Program Name: **B.Sc. Biotechnology**

PSO1: Strengthening the concepts of basic sciences to strategize developing a product beneficial to the society

PSO2: Develop a technical skill set for employability, entrepreneurship and a basic research aptitude

PSO3: Generate, Analyse and Interpret biological data

PSO4: Sensitize the students to the needs of a society and contribute towards its growth, such as improved crops, developing vaccines, biological diagnostic tools, improve microbial strains for biofuel production etc

PSO5: Understand the social aspects, ethical concerns and policies of the Biotechnology industry

Course outcomes for all courses offered by the department:

Semester	Course Code	Course name	Course Outcomes Student completing this course is able to
1	BC-1503	Basic Microbiology	1: To describe the history and scope of Microbiology 2: To understand and explain the structure of bacteria 3: To understand and explain virus and its structure 4: To describe various other microbes like archea.
1	BC-1504L	Basic Microbiology Practicals	1: To explain the importance of various instruments used in biochemistry. 2: To establish the concept with lab sessions 3: To cultivate and to identify microorganisms at elementary level.
2	BC-2503	Physiology	1: To explain the roll and mechanism of endocrine system in metabolism, regulation of normal homeostatic condition of body and other physiological functions 2: To explore the molecular mechanisms involved in blood clotting, production of erythrocytes, leucocytes and thrombocytes. This also gives an insight into molecular mechanisms that could be induced to enhance production of cells <i>in vitro</i> . 3: To demonstrate the underlying mechanisms involved in movement of different muscle types to facilitate specific functions. 4: To spell out the fundamental concepts and principles of bone system and neurophysiology. 5: To describe the importance of secretions and absorption in the body to aid digestion, circulation and excretions. The mechanisms involved will

			also enable comprehend what happens when there is any defect in any of the steps.
2	BC-2504L	Haematology	<ol style="list-style-type: none"> 1: To explain the importance of various instruments used in biochemistry. 2: To establish the concept with lab sessions 3: To analyse body fluids 4: Appreciate experiments carried out by scientists to enable understand the structure of biomolecules, understand their properties, design of experiments to prove the same and analyse the data and give interpretations
1	BT-1501	Basic Chemistry of Biomolecules	<ol style="list-style-type: none"> 1: To explain the importance of having water as a solvent system in cells 2: To spell out the importance of bonding and spatial arrangements of molecules for proper functioning and stability. 3: To establish the concept of how proper conformations are needed for optimum functioning of the molecules and thereby the entire cell 4: To specify how proteins, carbohydrates, lipids and nucleic acids can contribute to structural integrity of the cell as well as the biochemical reactions. 5: To analyse how a change in the structure of the molecules can lead to abnormalities, for eg. A mutated globin results in sickle cell anaemia 6: To state both the physical as well as chemical properties of these biomolecules, as these properties can be used to carry out various studies. 7: Appreciate experiments carried out by scientists to enable understand the structure of biomolecules, understand their properties, design of experiments to prove the same and analyse the data and give interpretations.
1	BT-1502L	Basic Chemistry of Biomolecules Practicals	<ol style="list-style-type: none"> 1: To explain the importance of various instruments used in biochemistry. 2: To establish the concept with lab sessions 3: To analyse and to identify carbohydrates 4: To experimentally prove both the physical as well as chemical properties of these biomolecules, as these properties can be used to carry out various studies. 5: Appreciate experiments carried out by scientists to enable understand the structure of biomolecules, understand their properties, design of experiments to prove the same and analyse the data and give interpretations.
2	BT-2501	Cell Biology	<ol style="list-style-type: none"> 1: To explain how the assembly of biomolecules to form a cell, which has been the crux of origin of

			<p>life and the evolutionary changes thereafter, especially, the role of RNA and genetic changes.</p> <p>2: To narrate of membrane biochemistry, transport across membranes and within cells by cytoskeleton</p> <p>3: To study the organization of the cell and the structure and functions of various organelles.</p> <p>4: To understand the structure and function of nucleus, cell division, cell cycle regulation and senescence</p>
2	BT-2502L	Basic Techniques of Cell Biology Practicals	<p>1: To learn the importance and use of microscope</p> <p>2: To isolate and analyse yeast cells</p> <p>3: Appreciate experiments carried out by scientists to enable understand the working of a cell, design of experiments to prove the same and analyse the data and give interpretations.</p>
3	BT-3501	Concepts in Biophysical Chemistry	<p>1: To state the basic concepts of physics like adsorption, viscosity, surface tension, absorption of light to be able to apply in understanding concepts in biochemistry</p> <p>2: To correlate the use of a particular technique to understand a fundamental.</p> <p>3: To justify that the discovery and advancement of biophysics has opened up understanding pathways and mode of actions of various biological systems.</p> <p>4: To apply the techniques for production, analysis and modifications of biomolecules.</p> <p>5: Design experiments with appropriate techniques in the methodologies and analyze the data obtained.</p>
3	BT-3502	Molecular Biology	<p>1: To analyse the experiments carried out by various scientists to prove that DNA is the genetic material,</p> <p>2: To explain the structure and properties of DNA;</p> <p>3: To narrate the mechanisms of DNA replication, transcription and translation in prokaryotes</p> <p>4: To evaluate how DNA damage can lead to detrimental effects and how DNA repair systems in the cells try to prevent mutations before being inherited.</p> <p>5: To outline how cells regulate expression of genes during transcription</p> <p>6: Appreciate experiments carried out by scientists to enable understand the Central Dogma of life</p>
3	BT-3503L	Fundamentals of Biophysical techniques and Molecular Biology	<p>1: Appreciate experiments carried out by scientists to enable understand genetic material</p> <p>2: To apply the techniques used in biosciences.</p>

4	BT-4501	Concepts in Microbiology	<p>1: To explain the morphology of a prokaryotic cell and the fine structure of its organelles</p> <p>2: To differentiate between eubacteria, archaeobacteria, fungi, algae and viruses and comprehend their economic importance.</p> <p>3: To justify the discovery and advancement of microscopic techniques has led to revolutionizing the field of microbiology</p> <p>4: To describe the basic growth requirements of bacteria in vitro in order to culture them.</p> <p>5: To know methodologies to control the growth of microbes by various sterilization techniques and chemotherapeutic drugs. For example: Milk is pasteurized to ensure that its shelf life is long; keeping surgical tools and rooms free of pathogens etc.</p> <p>6: To defend that good bacteria play a major role in industries especially food industries</p> <p>7: To justify how microbes have been a tool to minimise use of chemicals, improvise waste water treatment and decreasing environmental pollution by biodegradation</p> <p>8: Appreciate experiments carried out by scientists to enable understand the use of microbial systems in enhancing the quality of life.</p>
4	BT-4502	Recombinant DNA Technology	<p>1: To explain the basic tools required in recombinant DNA technology</p> <p>2: To explore the methods used to study gene location and structure</p> <p>3: To know the various techniques used to study the gene expression and regulation</p> <p>4: To demonstrate the techniques used in analysing transcripts and proteins</p> <p>5: To narrate problems associated with production of recombinant molecules</p> <p>6: To evaluate the use of recombinant DNA technology in betterment of the society</p> <p>7: Appreciate experiments carried out by scientists to enable understand various molecular mechanisms</p>
4	BT-4503L	Fundamentals of Microbiology and Recombinant DNA Practicals	<p>1: Appreciate experiments carried out by scientists to enable understand genetic materials</p> <p>2: To apply the techniques for understanding microorganisms</p> <p>3: Design experiments to isolate Microorganisms</p>
5	BT-5403	Genetics	<p>1: Apply the principles of Mendelian inheritance and their extensions by analysing inheritance patterns from crosses</p> <p>2: Map genes in microorganisms and eukaryotes by 2- or 3-point test crosses</p>

			<p>3: Describe the origins and genetic consequences of mutations and chromosomal abnormalities</p> <p>4: Describe the concept of maternal inheritance, epigenetics and evolutionary genetics</p> <p>5: Analyse basic processes in population genetics, mutation, migration, natural selection and genetic drift and describe how they affect the genetic diversity within a species</p> <p>6: Appreciate experiments carried out by scientists to enable understand genetics</p>
5	BT-5501	Metabolism	<p>1: To understand simple concepts related to metabolism,</p> <p>2: To see the correlation between energy molecules, reducing equivalents and pathways;</p> <p>3: To comprehend how metabolism is regulated by enzymes and hormones</p> <p>4: To compare anabolic and catabolic pathways of carbohydrates, proteins and nucleic acids and comprehend how any defect in a pathway could lead to diseases.</p> <p>5: Appreciate experiments carried out by scientists to enable understand the pathways and cycles of metabolism</p>
5	BT-5502	Enzymology	<p>1: To describe the structures and functions of enzymes and its classification</p> <p>2: Relate the parameters associated with enzyme activity</p> <p>3: To outline mechanisms of catalysis and the involvement of various cofactors and coenzymes in the process;</p> <p>4: To know concepts on how to purify a protein using various techniques</p> <p>5: To reason out how the rate of reaction of an enzyme is affected by physical and chemical factors</p> <p>6: To differentiate between regulatory enzymes and non regulatory enzymes through kinetic studies</p> <p>7: Appreciate experiments carried out by scientists to enable understand the pathways and cycles of metabolism</p>

5	BT-5503	Immunology	<p>1: To describe the immune system of our body, the different organs and cells that enable us to fight viruses and pathogens,</p> <p>2: To assess the significance of antigen and antibody interactions and use this specificity for various applications;</p> <p>3: To explain underlying mechanisms allowing the immune cells and molecules to kill the pathogens just like an army defends ones country</p> <p>4: To fathom what would happen if the mechanisms sensitize our body such that it proves detrimental to our own system eg. Asthmatic attacks</p> <p>5: To prove that a natural phenomenon can be used as a basis to producing vaccines, which have been responsible for eradication of diseases like small pox and polio</p> <p>6: To demonstrate that experiments carried out by scientists to enable understand the mechanisms underlying immune responses</p>
5	BT-5504	Environmental Biotechnology	<p>1: To explain the importance of requirement of alternate fuels and its production</p> <p>2: To assess the reclamation of contaminated water and soil by bioremediation</p> <p>3: To evaluate how microbes are able to degrade xenobiotics</p> <p>4: To estimate how microbes enable assimilability of nutrients</p> <p>5: To predict using biological systems to recover trace elements, to control growth of weeds, pests etc.</p> <p>6: To assess to clean the environment by waste water and solid waste management</p>
5	BT-5505L	Fundamentals of Enzymology, Immunotechniques and Environmental Biotechnology	<p>1: Appreciate experiments carried out by scientists to enable understand the pathways and effect of enzymes.</p> <p>2: To understand use of immunological techniques to study immunology</p> <p>3: To differentiate between regulatory enzymes and non regulatory enzymes through kinetic studies</p>
6	BT-6403	Entrepreneurship and Bioinformatics	<p>1: To understand the basic requirements needed to start a small scale company and the importance of market and product analysis before launching a product</p>

			<p>2: The characteristics of an entrepreneur and how to write a business proposal</p> <p>3: To understand the basics of bioinformatics and importance of database maintenance</p> <p>4: To demonstrate the the various software developed for database management, retrieval and analysis</p> <p>5: To appreciate the various applications of Bioinformatics especially in drug designing, speciation, study of phylogenetic trees and evolution etc.</p>
6	BT-6501	Plant Biotechnology	<p>1: To evaluate the concept of <i>in vitro</i> micropropagation and its various techniques</p> <p>2: To define the various mechanisms of transfer of desired DNA into plant cells</p> <p>3: To appreciate the benefits of protoplast isolation and fusion</p> <p>4: To assess the benefits of somaclonal variations in crop improvement</p> <p>5: Know the basic experimental designs required for a successful transfer of plantlets from labs to farms</p> <p>6: To state the importance of secondary metabolites and their production for commercial use</p> <p>7: Appreciate use of bioreactors, details of designs of bioreactors for large scale production of useful products</p>
6	BT-6502	Animal Biotechnology	<p>1: To explain the concept of growing animal cells <i>in vitro</i></p> <p>2: To describe the importance of specifications in design of laboratory and working to avoid contamination</p> <p>3: To demonstrate how transfection studies enable production of cloned products necessary for medical and pharmaceutical applications</p> <p>4: To analyse experimental designs by scientists to develop techniques for production of vaccines, monoclonal antibodies etc.</p> <p>5: To evaluate how animal cell culture has been instrumental in basic research</p>
6	BT-6503	Fermentation Biotechnology	<p>1: To describe the growth parameters of microbes <i>in vitro</i> and their optimization for large scale production</p> <p>2: To write down Sterilization processes needed for fermentation technology</p> <p>3: To draw down the basic design of fermenters</p> <p>4: To comprehend the requirement of processing and recovery of pure products.</p>

			5: To describe different industrial applications of fermentation
6	BT-6504	Project	1: To practice acquired knowledge in biotechnology for project development. 2: Identify, discuss and justify the concepts involved in the chosen project with a comprehensive and systematic approach. 3: Communicate and report effectively project related activities and findings.
6	BT-6505L	Fundamentals of Plant and Animal Biotechnology and Fermentation Biotechnology Practical	1: To learn the nuances of animal cell culture 2: Appreciate experiments carried out by scientists to enable understand fermentation 3: Appreciate experiments carried out by scientists to enable understand PTC
1	EG-1309	Biostatistics	1: To explain basic concepts of statistics and its application in biology 2: To collect sample, categorize the data and understand variables 3: Use measurements of central tendencies, deviation and errors 4: Analyse data and depict data 5: To solve problems involving Permutations, Combinations and Probability 6: Use simple statistics softwares for substantiating data
3	EG-3310	Mathematics for Biology	1: To explain various concept such as coordinate geometry, vectors, differentiation, integration and trigonometry 2: To correlate the principles of these topics in biological research 3: To apply the concepts in biotechnological studies
4	EG-4309	Nutrition	1: To explain simple concepts related to Nutrition like balanced diet, RDA etc., 2: To correlate between food and energy requirements and utilization; 3: To demonstrate why the body requires carbohydrates, lipids and proteins in specific quantities and how its deficiency or excess can lead to disorders 4: To assess the contribution of minerals, trace elements and vitamins to the wellbeing of humans. 5: Appreciate experiments carried out by scientists to enable understand the requirement of different molecules by the body