

B.SC. BIOTECHNOLOGY PROGRAM (CBCS)

PROGRAMME OUTCOMES

PO1: Graduate Attributes

A graduate student shall be able to develop skill and acquire knowledge in fundamentals of Chemistry, Biology and will develop disciplinary theory and practical knowledge in the diversified areas of Biochemistry. The students are given fundamentals in each course and they are encouraged to become unique by allowing them to perform experiments in the areas of their interest. This will enable the students to equip themselves with the basic practical training in different areas of Biochemistry having various Biomolecules, nature and their structure and function. to take up further specialized Master level courses in these areas or to take up suitable assignments/jobs in Biotech/Biochemical industries. The students shall enjoy the academic freedom which will bring out the best from each student. These attributes are elaborated as under:

PO2: Disciplinary Knowledge:

- a) Ability to understand fundamental concepts of biology, chemistry and biochemistry.
- b) Ability to apply basic principles of chemistry to biological systems and molecular biology.
- c) Ability to relate various interrelated physiological and metabolic events.
- d) A general awareness of current developments at the forefront in biotechnology, biochemistry and allied subjects.
- e) Ability to critically evaluate a problem and resolve to challenge blindly accepted concepts.
- f) Zeal and ability to work safely and effectively in a laboratory.
- g) Good experimental and quantitative skills encompassing preparation of laboratory reagents, conducting experiments, satisfactory analyses of data and interpretation of results.
- h) Awareness of resources, and their conservation.
- i) Ability to think laterally and in an integrating manner and develop interdisciplinary approach.
- j) Overall knowledge of the avenues for research and higher academic achievements in the field of Biotechnology and allied subjects.

PROGRAMME SPECIFIC OUTCOMES

PSO1: Communication Skills:

- a) Ability to speak and write clearly in English
- b) Ability to listen to and follow scientific viewpoints and engage with them.

PSO2: Critical Thinking:

- a) Ability to substantiate critical readings of scientific texts in order to persuade others.
- b) Ability to place scientific statements and themes in contexts and also evaluate them in terms of generic conventions.

PSO3: Problem Solving:

- a) Ability to closely observe the situation, and apply lateral thinking and analytical skills. Analytical

PSO4: Reasoning:

- a) Ability to evaluate the strengths and weaknesses in scholarly texts spotting flaws in their arguments.
- b) Ability to use critics and theorists to create a framework and to substantiate one's argument in one's reading of scientific texts.

PSO4: Research-Related Skills:

- a) Ability to problematize; to formulate hypothesis and research questions, and to identify and consult relevant sources to find answers.
- b) Ability to plan and write a research paper.

PSO5: Teamwork and Time Management:

- a) Ability to participate constructively in class room discussions.
- b) Ability to contribute to group work.
- c) Ability to meet a deadline.

PSO6: Scientific Reasoning:

- a) Ability to analyze texts, evaluating ideas and scientific strategies.
- b) Ability to formulate logical and convincing arguments. Reflective Thinking: Ability to locate oneself and see the influence of location—regional, national, global— on critical thinking.

COURSE OUTCOMES

BBT-1001 Chemistry

- Students will learn different fundamentals of basic chemistry of different chemistry branches like organic chemistry, Inorganic, Physical etc.
- Studies includes chemical bonding i.e. formation of different molecules types of bonds, hybridization, in thermodynamic studies free energy required for chemical and biochemical reactions and chemical kinetics rates of chemical reaction.
- In stereo chemistry how different molecules/ bio-molecules are presented by different methods along with their stereo aspects like chirality, etc.
- They will also learn electrochemical aspects during their course.
- They will also perform experimental verification of some parts of theory.

BBT-1002 Cell Biology

- Understanding of the structure of cell and various cellular events.
- Understanding of the function of various subcellular organelles.
- Students will learn about cell theory and techniques for fractionation of sub-cellular organelles.
- They will be acquainted to various microscopic techniques to visualize subcellular organelles.
- Students will have an understanding of the composition of cytoskeleton and extracellular matrix.
- Students will acquire knowledge of cell cycle, cell division and cell death mechanisms.

BBT-1003 English Communication

- Analyze and restate the meaning of a text in English
- Demonstrate the skill to write in English without grammatical error
- Practice listening effectively to communication in English
- Develop the ability to speak English language with the right way of pronunciation
- Express the viewpoints with confidence in English
- Express values and skills gained through effective communication to other disciplines
- Compose articles and compositions in English
- Discuss and socialize effectively in English

BBT-1004 A Biotechnology and Human Welfare

- Recognize the importance of various molecular techniques used in biotechnological industry and the importance of modern agriculture and its application.

- Understand the importance of biotechnology in relation to environment and pollution.
- Learn about various applications-based techniques in biotechnology like forensic science and the related activities currently going on and that will lay the foundations for the future work in relation to crime.
- Comprehend the application of biotechnology in therapeutic drug and vaccine development, gene therapy and diagnostics

BBT-1004 B IPR, Entrepreneurship, Bioethics and Biosafety

- Teachings like good laboratory procedure and practices, standard operating procedures for biotechnology research, legal and institutional framework for biosafety, international agreements and protocols for biosafety.
- learn about the Intellectual property rights and their usages to protect work created by human mind that has commercial value.
- Makes students aware about different national and international IPR issues including patents, trademarks, copyrights etc. and various international agreements and treaties.
- The course makes student understand the Regulatory bodies for Bioethics in India and International considerations.
- Students will become aware of Institutional Ethical Committee and International laws on Biosafety. Students will analyse and imbibe the Objectives and role of WIPO which will also help in interpreting impact of Intellectual property and its legal protection in research.
- The course is designed to have applications of research in innovation and entrepreneurship by involving the significance of patents and copyrights to have sustenance at global level.

BBT-2001 Mammalian Physiology

- Illustrate the integration of individual functions of all cells, tissues and organs into functional whole-human body
- Detect gross organs in the body
- Identify various bones of the skeletal system
- Find various blood indices
- Determine the blood groups
- Measure blood pressure
- Integrate the knowledge of whole body organs and their mechanisms.
- Compare various health conditions and their effects.

BBT-2002 Plant Physiology

- Understand the basics of plant physiology and physiological mechanisms governing plant growth and development
- Learn the basics of transport in plants and movement of solutes and water
- Remember the basics of photosynthesis, respiration and hormonal signalling as it impacts plant growth and development
- Comprehend and increase the awareness and appreciation for plants in environment, as well as to understand their diverse physiological functions.
- BBT-2003 Environmental Sciences
- Student understood the concept of environmental pollution, types of pollutants and related hazards.
- Acquire knowledge on environment protection acts and understand the need to conserve environment by implementing policies with the help of different organizations.
- Students will understand the structure, growth and the interactions of populations in the environment. Build awareness on disaster management, environmental movements and ethics.
- Field visit enhance the skill techniques among the students to document assets, study local polluted site and ecosystem structure and environmental impact.

BBT-2004 A Gene Organization, Expression and Regulation

- Define the roles of DNA and proteins in cell development and metabolism
- Determine the amino acid sequence of a protein given the nucleotide sequence of a gene.
- Describe the roles that the promoter, coding region, and, termination sequence of a gene play in gene expression.
- Recognize the differences between the structure of proteins, amino acids, genes, and nucleotides
- Draw the process of gene expression and include the following in your drawing. Gene, RNA polymerase, promoter, coding region, termination sequence, intron, cell, nucleus, cytoplasm, RNA, tRNA, ribosome, anticodon, codon, amino acid, protein, peptide bond.

BBT-2004 B Developmental Biology

- Name, describe and order the main stages of development common to most multicellular organisms.
- Describe the main anatomical changes that occur during development.
- Identify the cellular behaviors that lead to morphological change during development.
- Describe the hierarchy of gene activation that occurs in early Drosophila development.
- Understand how gene activation plays a role in differentiation and development.

- Describe the unique characteristics of the Hox genes and explain how they act as master regulators of development in multicellular organisms.
- Describe the main signaling pathways that play important roles in development.
- Explain how embryonic stem cells and their alternatives can be used in medical treatments

BBT-3001 General Biochemistry

- As Biochemistry is the branch of science concerned with the chemical and physico chemical processes and substances that occur within living organisms, therefore students will be able to understand how biomolecules relate to a particular process (metabolism) within a living cell.
- Students will be acquainted with the knowledge of structures, functions, and interactions of proteins, nucleic acids, carbohydrates and lipids.
- The course will help the students to understand the abnormalities in the metabolism their relationship to various diseases. In addition to, it will help to understand the mechanism underlying correct disorders with dietary modifications or genetic modifications.
- Students will learn about enzyme kinetics and types of inhibition as enzymes are important in catalyzing various reactions in the body

BBT-3002 General Microbiology

- To become aware with the contributions of Louis Pasteur, Edward Jenner and Robert Koch in microbiology and immunology.
- To get acquainted with the discovery of antibiotics and their targets, drug/antibiotic resistance, preventive and therapeutic approaches of infectious diseases, hospital acquired infections.
- Understanding the importance of microorganisms as model systems in genetics and biochemistry.
- To know the contribution of gut microbiome in human health.
- Exposure to the basic concepts of metabolic engineering and synthetic biology.
- To understand the concepts of fight against major killer diseases – tuberculosis, HIV and malaria.

BBT-3003 Genetics

- Students are able to understand the basic concept of transmission of genetics.
- Students enrich with the knowledge of Mendelian and Non-Mendelian genetics.
- Understanding the concepts of gene interactions and its applications in knowing genetic disorders.

- They learn about chromosomal aberrations and structure of chromosomes.

BBT-3004 Enzymology

- The subject is of relevance to students from a wide range of disciplines such as health, environment and medical sciences.
- Students will be able to proceed towards various concepts in biotechnology, the knowledge on enzyme and enzyme reactions.
- Enzyme kinetics will provide the importance and utility of enzyme kinetics in research.
- Students will learn critical analysis of scientific phenomena involving enzymes and will be able to competently work with enzyme systems in both academia and industry.
- Students will get an understanding of procedures involved in purification of enzymes, enzymes assays and quantitative evaluation of the influencing parameters such as concentrations of substrate / enzyme, pH, temperature and effects of inhibitors on enzyme activity.

BBT-4001 Bioanalytical Techniques

- Develop competence in handling various chromatographic techniques and apply them in isolating and characterizing different biological molecules.
- Understanding the applications of centrifugation and chromatography in biological investigations.
- Purify proteins by affinity chromatography using epitope tags such as histidine tag, GST tag, Flag tag etc.
- Understanding the principles of Electrophoresis, Spectrophotometry and ELISA and their applications in biological investigations/experiments.

BBT-4002 Intermediary Metabolism

- To understand the relevance, basic concepts and theories of chemistry as relevant to a biological system.
- To understand the properties of biomolecules and their nature of existence in the living system.
- To understand the relevance and basic concepts of experimental biochemistry.
- To understand the nature and commonly used types of biochemical experiments.
- To understand integration of metabolism with the help of different cycles.

BBT-4003 Immunology

- Understanding of the overview of immune system including cells, organs and receptors.

- To learn structure and functions of different classes of immunoglobulins, the genetic basis of antibody diversity and the importance of humoral, cell-mediated and innate immune responses in combating pathogens.
- To understand mechanisms involved in different types of hypersensitivity, and the importance of conventional vs recombinant vaccines.
- To get acquainted with the importance of antigen-antibody interaction in disease diagnosis.
- To understand the principles of tolerance, autoimmunity and the role of immunity in protection against pathogens.

BBT-4004 Molecular Diagnosis

- Demonstrate various diagnostic lab techniques such as identification of causative agent of disease using DNA or protein-based methods, microscopic analysis, and rapid immunoassay
- Perform molecular techniques which include the isolation of DNA and genetic manipulation, Rapid immunoassay, DNA fingerprinting analysis
- Appraise the significance of sensitive and accurate diagnosis in the detection of disease

BBT-5001 Molecular Biology

- Study the discovery of DNA as genetic material, DNA replication, transcription, DNA repair and translation.
- Analyse coding and non-coding regions of eukaryotic genome and their importance.
- Exposure with the importance of E. coli lac operon, PCR, expression vectors and their importance in Biotechnology.
- To produce insulin using recombinant DNA technology.
- Acquaintance with the merits and demerits of transgenic crops.
- Exposure to the concepts of genomics, proteomics, metabolomics and their importance in human health.

BBT-5002 Biostatistics

- The students will understand the principles of collection of data in biological experiments, proper statistical analysis of the data and its presentation.
- Students will understand the importance of sample size and various variables that affect data.
- Students will know the importance of mean, standard error, standard deviation, significance in presenting the data.

- Knowing statistical methods will help students in improving their analytical and interpretation skill.
- Students will acquire hands-on practical training to plan biological experiments with requisite sample size.
- After completion of experiments based on different sample sizes students will be able to perform proper statistical analysis of the data using mean, median, mode, variance and standard deviations.
- Students will be able to apply the principles of biological data management in real life situations.
- Statistical training will improve computational, mathematical and computer skills of the students by learning the use of ANOVA, AMOVA and student t-test.
- Students will be able to formulate a hypothesis, relevance to type of sample collected and sample size.

BBT-5003 Animal Biotechnology

- Students will understand the basic concepts and terminology used in animal tissue culture.
- Students will understand and evaluate cell cultures constraints and possibilities as an in vitro model.
- This course demonstrates knowledge of basic cell culture techniques
- Students will get the knowledge of how to establish a cell lines and its maintenance.
- This course demonstrates knowledge on design and how to use the cell culture facilities.
- Students will know the advantages and limitations of primary cell culture compared to immortalized or transformed cell lines.
- BBT-5004 Environmental Biotechnology
- They would understand and analyze environmental relationships with a better assessment of the mechanisms of environmental components like atmosphere, hydrosphere and lithosphere.
- Students will become skilled at basic theoretical concepts highlighting in the field of ecology, and how these are applied to different ecological approaches.
- The studies of ecology, biogeography and ecosystem structure will provide the awareness on ecological and historical foundations for understanding the distribution and abundance of species and the changes in their distribution and abundance over time and climatic impact.
- Student understood the concept of environmental pollution, types of pollutants and related hazards. Acquire knowledge of bioremediation and its applications in

environmental clean-up and various waste and disaster management methods and policies.

- Build awareness about environment conservation, environment protection acts. Studies on current global environmental issues will make aware to students about their causes and effect measure should be consider.

BBT-5005 Microbial Biotechnology

- Understands importance of microorganisms in various milk and food processing.
- Understand the significance and activities of microorganisms in various food and factors affecting on microbial growth in food leading to spoilage and understand the principles underlying the preservation methods.
- Recognize and describe the characteristics of important food borne pathogens, pathogenesis and prevention.
- Know the conceptual basis for understanding pathogenic microorganisms and mechanism of their pathogenesis, treatment and prevention.
- Explains various aspects of wastewater treatment, also know various test to determine potability of water.
- Acquire knowledge about application of microorganisms in bioleaching of metals, agriculture, biosynthetic and biosynthetic material production.
- Understands norms and regulations of GMO and its responsible use.
- BBT-6001 Recombinant DNA technology
- Students will take practical training in the recent techniques of recombinant DNA technology such as quantification of DNA, isolation of chromosomal DNA, isolation of plasmid DNA from bacterial cells, restriction digestion of DNA and their separation using Agarose gel electrophoresis, amplification of DNA fragment by PCR. With learning these techniques students will gain expertise to work further in the area of recombinant DNA technology.

BBT-6002 Genomics and Proteomics

- Be able to describe the development of Omics technologies, with emphasis on genomics and proteomics;
- Be able to synthesise information to discuss the key technological developments that enabled modern genomic and proteomic studies;
- be able to describe advanced genomics and proteomics technologies and the ways in which their data are stored;
- be able to use bioinformatics techniques to query examples of genomic and proteomic databases to analyse cell biology;

- be able to describe the different types of genome variation and their relationship to human diseases;
- be able to discuss how biological systems information relating to genes, proteins and cellular structures can be used to model living cells, and even to create new synthetic cells.
- Genomics: an introduction to genomics, databases and sequence comparison techniques, genes and the genome, principles and applications of DNA microarray technology, transcriptional profiling, micro-array applications, SNP, QTL and genotyping, modern genome sequencing, genome variation and phylogeny, biomes, and transcriptomics.
- Proteomics: early origins of proteomics, gel-based proteome profiling, the rise of different mass spectrometry methods, modern high throughput mass spectrometry, protein data bases

BBT-6003 Plant Biotechnology

- Learning outcomes for this course include detailed understanding of metabolic processes specific for plants such as nitrate assimilation, photosynthesis, respiration, nitrogen fixation and the role of different metabolic pathways in plant growth and development.
- Students will also gain insight to various stressful conditions of the environment that affect plant growth and productivity as well as the defense mechanisms in plants due to which plants survive under stresses.

BBT-6004 Bioinformatics

- By studying this course, the students completing B.Sc. Biotechnology will have an understanding of the tools of bioinformatics and computational biology and will be in a position to access biological data bases and softwares which will be helpful in understanding sequence alignments and predicting the structures of biomolecules such as proteins. Students will be exposed to available bioinformatics tools and databases.
- They will be in a position to comprehend the fundamental aspects of in-silico protein structure prediction.
- They will understand application of theoretical approaches to biological systems. Students will get trained in the application of programs used for database searching, protein and DNA sequence analysis, and prediction of protein structures.

BBT-6005 Bioprocess Technology

- This paper presents the basics of fermentation technology, media components as applied to lab scale, pilot scale and industrial scale upstream and down stream processing.

- This paper is introduced to acquire requisite skills for the design and development of bioreactors, production optimization, and preparation of sterile base materials for downstream processing.
- On successful completion of the course the students should have understood the basics of fermentation technology and learnt the concept of screening, optimization and maintenance of cultures.