

B.SC. BIOTECHNOLOGY PROGRAM (Annual)

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-101 Biochemistry and Biophysics

- Understanding of Biochemistry as a discipline and milestone discoveries in life sciences that led to establishment of Biochemistry as separate discipline.
- Fundamental properties of elements, their role in formation of biomolecules and in chemical reactions within living organisms.
- Understanding of the concepts of mole, mole fraction, molarity, etc. and to apply them in preparations of solutions of desired strengths.
- Unique property of water as a universal solvent and its importance in biological system.
- Understanding of fundamentals of physical phenomena associated with Adsorption, Viscosity, Distribution law, Osmotic pressure, etc. and their importance in living organisms.
- Understanding of concepts of acids, bases, indicators, pKa values, etc. Acquiring skill to determine pKa value of amino acids.
- Fundamental laws relating to photochemistry and applications of UV-visible, Fluorescence and IR spectrophotometry in analytical determination and characterization of biomolecules.
- Appreciation of the roles of metals, non-metals, transition metals and coordination compounds in biological systems.
- Apply the principles of radiochemistry to analytical determination of biomolecules and life processes.

BBT-102 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-103 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-104 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-105 Elementary Chemistry and Physics

- Understand the significance of organic reactions with reference to biological systems.
- Apply the principles of electrochemistry to conductance, voltaic, and electrolytic systems.
- Understanding chemical bonding, strong and weak interactions, hydrogen bonding and to apply these principles in various biomolecules and biological reactions.
- To develop understanding of aliphatic and aromatic compounds, IUPAC nomenclature, reactivity of functional groups and the importance of stereoisomers in biological systems.
- Understanding the formation of polymers and their importance; difference between biodegradable and non-biodegradable polymers and biohazards of polymers.
- Apply concept of stereochemistry in determining conformations of biomolecules.

BBT-201 Instrumentation and Bio-analytical 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-202 Biomathematics and 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-203 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-204 Immunology and Immunotechnology

- 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-205 Computational Biology and 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-301 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-302 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-303 Animal and Medical 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-304 Environmental and Industrial 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-305 Genomics, Proteomics, Intellectual Property rights and Entrepreneurship

- 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