

Department of Biotechnology

Programme Name- B.Sc Biotechnology

Programme outcomes

PO1: Students develop global competencies in the area of basic and applied biological sciences.

PO2: Enhancing the subject knowledge of students by using traditional and modern ICT based teaching methods and learning by doing.

PO3: To enrich students' knowledge and train them in various branches of Biotechnology such as genetics, molecular biology, biochemistry, immunology, fermentation technology, environmental biotechnology and tissue culture techniques.

PO4: To groom the students to meet futuristic challenges and national interests

Programme specific outcomes

PSO1: To bestow the students with all the research skills required to work independently

PSO2: To develop scientific temperament and social responsibilities in the students.

PSO3: To inculcate nature care by imparting knowledge of advance modern techniques

PSO4: As Biotechnology is an interdisciplinary course, empower the students to acquire technological knowhow by connecting disciplinary and interdisciplinary aspects of biotechnology.

PSO5: Acquire knowledge in students of biotechnology enabling their applications in industry and research.

Course outcomes

First Year

Course101—Fundamentals of Chemistry

After successfully completing this course, the students will be able to:

CO1: Students will learn different fundamentals of basic chemistry of different chemistry branches like organic chemistry, Inorganic, Physical etc.

CO2: 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.

CO3: In stereo chemistry how different molecules/ bio-molecules are presented by different methods along with their stereo aspects like chirality, etc.

CO4: They will also learn electrochemical aspects during their course.

CO5: They will also perform experimental verification of some parts of theory.

Course-Bbt102—Fundamental of Physics

CO1: Students will learn fluid mechanic by different measurement techniques

CO2: Using experimental, computational, and/or theoretical methods, students are able to understand geometrical optics and surface tension.

CO3: The students would developed their understanding of core Physics by learning Classical and Quantum Mechanics, Electricity and Electrodynamics,

Course- Bbt103- Basics of Plant and Animal Sciences

CO1: An understanding, deep knowledge about plants and the category of the living organisms as life form its features, Importance, Introduction to plants group.

CO2: Learning and getting familiar with morphology & plant cell.

CO3: Knowledge about unique, silent features and chemical compositions of cell wall.

CO4: Understanding the concept of classification and construction of animal organization of no chordates and non- chordates.

CO5: Understanding the different functional aspects of various system of animals vertebrates (frog) & invertebrates (honeybee)

CO6: Understanding the importance of parasites in human health

Course- Bbt104-Mathematics & Statistical Methods for Biologist

CO1: Students should be able to solve and interpret the practical real life problem.

CO2: Problem solving skills, creative talent to convert the verbal information into mathematical form are enhanced.

CO3: Interdisciplinary approach is developed.

CO4: Theoretical concepts are strengthened by solving maximum no. of problems.

CO5: To enhance abstract thinking of students.

Course -Bb105- Fundamentals of Biological Chemistry

CO1: 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.

CO2: Students will be acquainted with the knowledge of structures, functions, and interactions of proteins, nucleic acids, carbohydrates and lipids.

CO3: 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.

CO4: Students will learn about enzyme kinetics and types of inhibition as enzymes are important in catalyzing various reactions in the body

Course-Bb106—Biophysics and Instrumentation

CO1: Students will develop a conceptual understanding of connections between physics and biology.

CO2: Students will be able to explain the behavior and interactions between, matter and energy at both the atomic and molecular levels by different atomic models.

CO3: Students will gain an understanding of interpreting spectra and will be able to explain how spectroscopic methods are used for quantitative analysis of biomolecules.

CO4: Students will understand and interpret the nuclear processes such as radioactivity, fission, and fusion and their use in medicine.

CO5: Students will comprehend the molecular components which constitutes the cell membrane and give its different electrical and physicochemical properties. They will understand the importance of transport in the cells.

Course Bb107-Microbiology

CO1: Student understands microorganism as a model system in life science studies and its importance in biotechnology.

CO2: Students gets knowledge of Eubacteria and Archaeobacteria and differences in structure and composition of respective cell

CO3: Student learn to design artificial nutritional media for microorganisms and methods to grow them in laboratory.

CO4: Student learn different types of microorganisms, their applications in different sector.

CO5: Student gets knowledge about interaction between microorganisms and plant and animal that helps them to think about its use in Agriculture, Medical and health, Environment field.

Course-108-Computers and Applications

CO1: Students will get basic knowledge (handling devices, role of operating system etc.) of computers.

CO2: They will also familiar with how data gets stored through Database Management System.

CO3: They can distinguish between CUI and GUI operating system and handling the same.

CO4: They will capable to create documentation, budgets and mathematical calculations and also make attractive presentations using ms word, excel and Power point respectively

CO5: They can easily do surfing on internet.

Course—Bbt109-Practicals in Chemistry & Biochemistry

CO1: Ability to understand fundamental concepts of biology, chemistry and biochemistry.

CO2: Ability to apply basic principles of chemistry to biological systems and molecular biology.

CO3: Ability to relate various interrelated physiological and metabolic events.

CO4: A general awareness of current developments at the forefront in biochemistry and allied subjects.

CO4: Ability to critically evaluate a problem and resolve to challenge blindly accepted concepts.

CO5: Good experimental and quantitative skills encompassing preparation of laboratory reagents, conducting experiments, satisfactory analyses of data and interpretation of results.

CO6: Awareness of resources, and their conservation. CO7: Ability to think laterally and in an integrating manner and develop interdisciplinary approach.

CO8: Overall knowledge of the avenues for research and higher academic achievements in the field of biochemistry and allied subjects.

Course -Bbt110-Techniques in Physics, Biophysics & Instrumentation

CO1: Students will be able to understand the working principle and working of different instruments.

CO2: Through hands on training, students are able solve the problems by understanding the principle of pH meter, centrifuge, microscopes, thermometers and their application in analyzing different biological samples.

Course Bbt 111-Laboratory Exercises in Biosciences

CO1: Imparting practical knowledge on the importance of model system like *Drosophila*, honey bee, *Paramecium*.

CO2: In practical of microbiology, students would be able to handle microorganisms (bacteria and fungi), culture the microorganisms using different media, and observe them by staining the cells and observing under microscope.

CO3: Furthermore, the microbiology practicals would allow students to understand growth properties and functions of microorganisms *in vitro*.

CO4: In practices in biosciences, (Botany), students would be able to learn importance of morphological structure, classification, reproduction.

CO5: Students able to explain microscopic technique, Familiarize with the external and internal structure of lower and higher group organisms.

Course-112-Quantitative Methods in Biology

CO1: Students should be able to solve and interpret the practical real life problem.

CO2: Problem solving skills, creative talent to convert the verbal information into mathematical form are enhanced.

CO3: Interdisciplinary approach is developed.

CO4: Theoretical concepts are strengthened by solving maximum no. of problems.

CO5: To enhance abstract thinking of students.

Second Year

Course Bb211---Genetics and Immunology

CO1: As **Immunology** is the study of the immune system and is a very **important** branch of the medical and biological sciences therefore students will learn about various lines of defense.

CO2: Students will be able to understand how body fights infections from bacteria and viruses and the development of medical interventions to treat and prevent diseases

CO 3: Students will be acquainted with knowledge of the role of immune responses in the development of many common disorders not traditionally viewed as immunological, including metabolic, cardiovascular, and neurodegenerative conditions.

CO4: Immunology is also fundamental to the life sciences industry; the discipline is core to the development of modern antibody therapies, cellular therapies, small molecule drugs, vaccines and 'biologics' (therapeutic biomolecules).

Course Bb212---Cell Biology

CO1: Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles.

CO 2. Students will understand how these cellular components are used to generate and utilize energy in cells.

CO 3. Students will understand the cellular components underlying mitotic cell division.

CO 4. Students will apply their knowledge of cell biology to understand various physiological and developmental functions like ageing ,apoptosis, cancer etc.

CO5: The knowledge of cell biology is used as basic for other subject like molecular biology, genetics.

Course Bb213—Environmental Biology and Biotechnology

After successfully completing this course, the students will be able to:

CO1: They would understand and analyze environmental relationships with a better assessment of the mechanisms of environmental components like atmosphere, hydrosphere and lithosphere.

CO2: 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.

CO3: 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 management methods.

CO4: Build awareness about environment conservation and environment protection acts.

CO5: Studied importance of Environmental Impact Assessment (EIA), remote sensing and Geographical Information System (GIS) in the management of environment

Course Bb214- Practicals in Environmental Biotechnology

After successfully completing this course, the students will be able to:

CO1: Through local field visit student learned various parameters for analysis of community sampling and gets hands on training for collection of data and analysis.

CO2: At laboratory scale they are able to perform, understand and analyze the soil properties of polluted and non-polluted soil.

CO3: Student understood the concept and consequences of various environmental pollution by performing BOD and COD assays.

CO4: Students will learn about the vital importance of EIA system in projects development to environmental safety and to ensure sustainable development, by studying a CASE study.

CO5: Hands on training on GIS remote sensing techniques helps students in environment management and conservation

Course Bb215- Practicals in Cell Biology and Genetics:

After successful completion of this lab course, student will be able to do the following:

CO1: Students will get practical experience in understanding different cell structure, its organelles by isolating the organelle.

CO2: To learn the laws of heredity with practical emphasis on inheritance

CO3: Students would be able to identify and outline the structure of a eukaryotic cell at different magnification, measure the cell length and breadth using micrometry, different stages of mitosis and meiosis.

CO4: Students would be able to identify and distinguish different blood cells, to solve simple genetic problems and analyze Human karyotype and pedigree.

Course Bb221- Molecular Biology

CO1: Students understand the chemical and molecular processes that occur in and between the cells.

CO2: Students will acquire the knowledge of structure and functions of nucleic acids, proteins and their interaction within cell to promote cell growth, division and development.

CO3: Students understand the concept of how the DNA, RNA and proteins are synthesized and transported in the cell by the processes of replication and transcription.

CO4: Students can illustrate the structural organization of genes and the control of gene expression.

CO5: Students will gain the knowledge of organization of genomes and the mechanism of genome regulation at transcriptional and post transcriptional level.

Course Bb222- Animal and Plant Development

Students will understand the various topics under different units of developmental biology.

CO1: Students will understand the principals of development as they are able to describe the developmental process in both plants & animal sciences.

CO2: Students will understand various developmental process of cellular ageing and cell death and teratogenesis.

CO3: This course will help students to understand the importance of model systems like *Drosophila*, *Aradioposis* for explaining the role of different genes in patterning and development.

CO 4: Students understood the basic concepts of stem cells and its applications in various fields of biotechnology.

CO5: Students will also understand the basic development pathways depicted with diagrams.

Course Bb- 223 Scientific Writing and Communication

CO1. High quality scientific writing is crucial for success in science, both for students and professional scientists. Many things depend from ability to effectively communicate

research results, such as publishing an article or the number of citations this article receives.

CO2: It include: principles of good **writing**, tricks for **writing** faster and with less anxiety, the format of a scientific manuscript, peer review, grant **writing**, ethical issues in scientific publication, and **writing** for general audiences.

CO3. Scientists write to communicate their research results and findings with other scientists or experts. In this way, information is shared in a systematic manner, so that researchers can build upon the work of others.

CO4. Although there are different ways to share information amongst the scientific community, such as oral or poster presentations on scientific conferences, science blogs, or data warehouses, written reports, especially those reviewed by peer scientists and published in international journals, are still the most effective way to add research outcomes to the body of scientific knowledge.

CO5. Scientific writing has a long tradition and since the first half of the 20th century, the IMRAD structure has become the dominant structure for scientific reports reporting original research (most journal articles, congress papers, bachelor and master theses, etc.).

Course Bb224- Metabolic Pathways

CO1: The course will help the students to understand various life-sustaining chemical reactions in organisms, the knowledge of the individual pathways, the energetics of the reactions, the cofactor requirements, and the chemical transformations of molecules in the sequence including the mechanism of reaction, and the enzyme catalysts themselves.

CO2: The primary focus of this course is on the pathways of intermediary metabolism by which all cells synthesize and degrade carbohydrates, lipids, and nitrogenous compounds.

CO3: The course will help in understanding the regulation of various pathways.

CO4: The end-products from one pathway serving as the entering molecules for a subsequent sequence. Subsequently, one can integrate various metabolic pathways.

CO5: The subject enable students to design creative, lucid experimental approaches required in other disciplines.

CO6: Finally, the students will learn how several human diseases arise from defects in metabolic pathways.

Course Bb225- Practicals in Molecular Biology

CO1: The students will learn ethics of working in the laboratory, which includes handling of instruments and reagents pertinent to molecular biology. Moreover, they will be able to prepare minuscule amounts of reagents.

CO2: The course allows extraction of biomolecules like DNA, RNA, proteins from cells of prokaryotic and eukaryotic origin.

CO3: Using various techniques, like agarose gel electrophoresis, SDS-PAGE, and other biochemical methods, students would be able to observe, analyze, and quantitate the expression or amounts of nucleic acids and proteins in the cells.

Course Bb226- Practicals in Developmental Biology

CO1: The course imparts practical knowledge on identification of different developmental stages in both plants and animals.

CO2: Students will learn to identify and characterized the various developmental aspects by handling various model systems like Chick, Frog.

Third Year

Course Bb331-Microbial Biotechnology

CO1: Microbial Biotechnology introduces the students to the fascinating world of Microbes with astonishing abilities to produce diverse metabolites. By studying the history the students realize the importance of Scientist their hardwork and perseverance towards research. It helps to inculcate values like adapting research methodology, logical reasoning and aptitude amongst the students.

CO2: This course will introduce the students to new domains of Microbiology like Food and Dairy, Pharamaceutical, Waste Water treatment, Geomicrobiology and GMM. These domains will help in opening new avenues and carrier opportunities for biotechnology students in various industrial sector.

CO3: The clear understanding of production and applications of Biofertilizer Breweries Wineries will help developing entrepreneurship ideas in the students.

CO4: The molecular level adaptations of Microbes in various environmental conditions will help in vivid understanding of their survival in some extreme environment like hot springs, Antarctica region or Space. This opens up innovative study areas like Astrobiology. Basis of why a microbe can survive in different diverse condition was understood by the student

CO5: In order to go for large scale production of any microbe or microbial product, what are the steps to be followed, how is a Bacteria establishing itself in a artificial media was conceptualized by the students.

Course Bb332---Plant and Animal tissue culture

CO1: Students will understand the basic concepts and terminology used in both animal and plant tissue culture.

CO2: Students will understand the concepts to establish different types of in vitro cultures by themselves.

CO3: The knowledge of tissue culture techniques will help the students for designing projects, practicals.

CO4: Students will understand development of cell lines their establishment which helps them to work on various related projects .

Course: Bb-333 Biodiversity and Systematics

CO1: On successful completion of this course the students will be able to illustrate the importance of biodiversity for upcoming science and economy.

CO2: The main objective of this course is to provide the students with possibilities of acquiring information on biodiversity, its main principles to know the criteria and various methods used for measurement of biodiversity richness and abundance.

CO3: The most important outcome is that they would gain knowledge on the tools for policies, acts and laws used in nature conservation and management. Conceptual insight on protected areas management – Management Institutions, legislation and their problems, perspective biodiversity strategy.

CO4: Students will develop an understanding of biodiversity with respect to biome (terrestrial) and aquatic ecosystem.

CO5: Studies on taxonomy and systematics will provide foundation to study the diversity of living world and its evolutionary perspective to biodiversity.

Course---Practical in Tissue Culture

CO1: Students will be competent enough to work in animal and plant tissue culture lab with proper knowledge of aseptic handling techniques.

CO2: The primary outcome is that student will learn subculturing of animal cells and the technique of trypsinization.

CO3: Students will get well acquainted with techniques like embryo culture, anther culture, and axillary bud culture concerned with the plant tissue culture.

CO4: The utmost important outcome is the students will have an exhaustive hands on training regarding the various plant and animal tissue culture with respect to the handling of different explants, various invitro techniques of tissue culture.

CO5: Students will be able to handle and isolate lymphocytes from blood and be able to stain and culture them.

Course- Bb-335 Practicals in Microbial Biotechnology

CO1: Student gets hands on training for using microorganisms for human benefits

CO2: Students practices various techniques which help them during actual use of microbes in industry.

CO3: In laboratory student learns to check bacteriological quality of water. Use of microorganisms in environmental cleanup is understood by field visit.

CO4: Students learns various quality testing parameter of milk and milk product.

CO5: Students learn techniques of studying effect of various parameter on growth of microorganisms.

Course-- Bb-341 Large scale Manufacturing Processes

CO1: On successful completion of this course students should have an understanding of the variety of fermentation and subsequent processing approaches available for the manufacture of biological products and

CO2: To make student understand about design and operation of these systems. an appreciation of the regulatory framework under which the industry operates

CO3: To make students acquainted with principles of using of microorganisms in fermentation process.

CO4: Attain knowledge of production equipment in fermentation industry, application of microorganisms and enzymes in technological operation, substrate preparation and control of fermentative process and isolation of products.

Course--- Bb-342 Biochemical and Biophysical Techniques

CO1: The main objective of this course is to provide the students with possibilities of acquiring basic understanding of physical and chemical concepts in biochemistry and biophysical techniques.

CO2: The most important outcome is that students would gain deep knowledge on the tools, principles and working for microscopy, spectrophotometer, centrifugation, chromatography, and electrophoresis.

CO3: This course will be equally beneficial to various scientific areas including life science, chemical science, material science and environmental science as students get explored with analytical techniques along with their theory, working principal, common instrumentation and their applications.

CO4: This will explore and highlight deep understanding as new computational technologies for a 21st century science of biochemistry research and techniques in relationship to biomolecules and structures.

CO5: This is a course that develops students skills required for competitive world in pursuing advanced degrees in biotechnology, biochemistry and pharmaceutical fields.

Course----Practicals in Recombinant DNA Technology

Course----Techniques in Genetic Engineering

CO1: The students will be competent to perform genetic manipulation experiments by learning basic and advanced techniques on plasmids, expression vectors, cloning and construct of genomic libraries.

CO2: The recombinant DNA technology course give emphasize to make students familiar with molecular biology in the context of the application of recombinant DNA technology in basic and applied research.

CO3: The most fundamental outline in a genetic engineering to impart deep knowledge among students regarding mechanism of action and the use of restriction enzymes, different probes for specific genes of interest.

CO4: Students will get explored to various techniques like bacterial transformation, DNA sequencing technique, restriction mapping and DNA fingerprinting in relation to their application in medical and pharmaceutical field.

CO5: This is courses that build up student's deep knowledge towards the modern approaches for genetically modified organisms.

Course- Bb-344 Practicals in LSMP and BBT

CO1: Student practically learn technique of isolation, screening of microbial strain for fermentation process.

CO2: Students practices various techniques in fermentation process such as inoculum production, fermentation and purification of product.

CO3: Students gets idea of large scale production, preparation of instruments etc. by visiting to fermentation industry.

CO4: Students gets exposure to learn various biochemical techniques useful in industries

CO5: They understand able to prepare various chemical and solutions.

CO6: They develop a competitive skill by learning biochemical techniques in relation to biomolecules and structure
