

DEPARTMENT OF BIOTECHNOLOGY

Program Outcome (PO), Program Specific Outcome (PSO) and Course Outcome (CO)

B.Sc. HONOURS BIOTECHNOLOGY

PROGRAM OUTCOMES (PO)

The Program Outcomes are the outline of the expected Course Outcome mentioned in the beginning of each course. The characteristic attributes that a B.Sc. Honours Biotechnology will be able to demonstrate through learning various courses are listed below:

1. Problem Analysis and Use of Technology

Think critically, identify, analyze problems/ situations and further attempt to design/ develop solutions that meet the specified goals. Apply appropriate IT tools efficiently in their daily activities of communication and academics.

2. Environmental sustainability and Ethics

Analyze and attempt solutions to environmental issues and commit themselves to sustainable development in the local/ national and global context. Recognize and understand professional ethics /human values and be responsible for the same.

3. Individual and Team work, communication and life skills

Function effectively at various levels, capacities and situations. Communicate proficiently (oral and written) as a responsible member of society.

4. Research Aptitude and Social responsibility

Understand general research methods and be able to analyze, interpret and derive rational conclusions. Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of domain specific change.

5. Critical thinking, Analysis and Problem Solving

Demonstrate proficiency in quantitative reasoning (critical thinking) and analytical skills. Also, be able to use these skills to analyze and solve industry related problems, thus preparing them for a successful career in industry and research institutes

6. Understanding the need for sustainable solutions

Be able to understand the need and impact of biotechnological solutions on environment and societal context, keeping in view the need for sustainable solutions.

7. Development of practical skills

Equipped with practical skills and the ability to apply their theoretical concepts to design, perform experiments, analyze and interpret data and thus develop proficiency in laboratory management.

8. Developing an inclination towards research

Develop an inclination towards research through the compulsory internship in industry/research/academic institutes which promote and inculcate professional ethics and code of practice among students, enabling them to work in a team with a multidisciplinary approach.

PROGRAM SPECIFIC OUTCOME (PSO)

1. Students will get the basic level knowledge about biological concepts, relationships between organisms, and various cell types including microorganisms, their structure, functions and their interactions with each other and to the environment.
2. Students get aware about tools and techniques for estimation of biomolecules with their genetical and biochemical characteristics. Moreover, students get insight into various diseases of human body and methods of their prevention and treatment. Students would know about different theories and approaches to bioethics and its associated conflicts with GMO. They will know about how human cloning is surrounded by different bioethical issues. This subject will make students familiar with biostatistical concepts that will help in experimental set up and result interpretations. Be able to list the types of characteristics that make an organism ideal for the study of developmental biology.
3. Students will get fundamental knowledge about mechanism of production of useful industrial products using microorganism, plants and animals. Students will aware of environmental issues and their possible remedies using ecofriendly methods. Students will learn to store and retrieve biological information on various databases to use in research.

BHBT 101: BASIC BIOLOGY

Course Outcome

Students who successfully complete this course will be able to:

- CO 1 Define basic biological concepts and processes.
- CO 2 Describe levels of organization and related functions in plants and animals.
- CO 3 Identify the characteristics and basic needs of living organisms.
- CO 4 Explain the processes of growth and development in individuals and populations.
- CO 5 Describe the relationships between organisms and their environment.

BHBT 102: GENERAL MICROBIOLOGY I

Course Outcome

Students who successfully complete this course will be able to:

- CO 1 Describe cellular, biochemical, and physiological aspects of microorganisms and recognize the similarities and differences between microbial groups (bacteria, archaea, fungi, protozoa, viruses, viroids, and prions).
- CO 2 Explain cellular and biochemical processes involved in pathogenesis (human-pathogen interactions).
- CO 3 Identify microorganisms and their role in various environments.
- CO 4 Describe the cultural use of microorganisms in food production, medicine, fuel production, and waste treatment.
- CO 5 Apply microbiology techniques (cell culture, chemical and molecular based methods) to solve scientific problems.

BHBT 106: ENVIRONMENTAL STUDIES AND ROAD SAFETY AWARENESS

Course Outcome

Students who successfully complete this course will be able to:

- CO 1 Describe plant and animal distribution patterns in relation to abiotic and biotic factors.
- CO 2 Define the essential characteristics underlying natural ecosystems.
- CO 3 Explain model population and community-level dynamics.
- CO 4 Interpret and present ecological results.
- CO 5 Identify global environmental problems.

BHBT 201: CELL BIOLOGY

Course Outcome

Students who successfully complete this course will be able to:

- CO 1 Describe cytological, biochemical, physiological and genetic aspects of the cell, including cellular processes common to all cells, to all eukaryotic cells as well as processes in certain specialized cells.
- CO 2 Relate normal cellular structures to their functions.
- CO 3 Explain cellular processes and mechanisms that lead to physiological functions as well as examples of pathological state.
- CO 4 Apply modern cellular techniques to solve aspects of scientific problems.
- CO 5 Describe the intricate relationship between various cellular structures and their corresponding functions.

BHBT 202: GENERAL MICROBIOLOGY II

Course Outcome

Students who successfully complete this course will be able to:

- CO 1 Describe how microorganisms are used as model systems to study basic biology, genetics, metabolism and ecology.
- CO 2 Identify ways microorganisms play an integral role in disease, and microbial and immunological methodologies are used in disease treatment and prevention.
- CO 3 Explain why microorganisms are ubiquitous in nature; inhabiting a multitude of habitats and occupying a wide range of ecological habitats.
- CO 4 Cite examples of the vital role of microorganisms in biotechnology, fermentation, medicine, and other industries important to human well being.
- CO 5 Demonstrate that microorganisms have an indispensable role in the environment, including elemental cycles, biodegradation, etc.

GN-201: DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION

Course Outcome

Students who successfully complete this course will be able to:

- CO 1 Identify the psychotherapeutic benefits (if any) and harmful effects of common substances of abuse, while identifying the populations most at risk of using these substances.
- CO 2 Apply the current public health perspectives to evaluate the topic of substance abuse prevention.
- CO 3 Compare and Contrast reliable public data sources to find statistical and epidemiologic data on incidence, prevalence, and trends in drug, tobacco and alcohol use.

BHBT301: GENETICS AND MOLECULAR BIOLOGY

Course Outcome

Students who successfully complete this course will be able to:

- CO 1 Apply quantitative problem-solving skills to genetics problems and issues.
- CO 2 Demonstrate their ability to reason both inductively and deductively with experimental information and data.
- CO 3 Describe the chromosome theory, molecular genetics and quantitative and evolutionary genetics.
- CO 4 Select and apply experimental procedures to solve genetic problems.

BHBT302: BIOCHEMISTRY

Course Outcome

Students who successfully complete this course will be able to:

- CO 1 Understanding of Biochemistry as a discipline and milestone discoveries in life sciences that led to establishment of Biochemistry as separate discipline.
- CO 2 Fundamental properties of elements, their role in formation of biomolecules and in chemical reactions within living organisms.
- CO 3 Understanding of the concepts of mole, mole fraction, molarity, etc. and to apply them in preparations of solutions of desired strengths.

- CO 4 Unique property of water as a universal solvent and its importance in biological system.
- CO 5 Understanding of fundamentals of physical phenomena associated with Adsorption, Viscosity, Distribution law, Osmotic pressure, etc. and their importance in living organisms.
- CO 6 Understanding of concepts of acids, bases, indicators, pKa values, etc. Acquiring skill to determine pKa value of amino acids.

BHBT303: IMMUNOLOGY

Course Outcome

Students who successfully complete this course will be able to:

- CO 1 Identify major components of the immune system at organ, cellular and molecular levels.
- CO 2 Discuss normal functions of these components during immune responses.
- CO 3 Elucidate the relationship between major cellular and molecular components of the immune system.
- CO 4 Explain adverse functions of these cellular and molecular components during abnormal circumstances.
- CO 5 Describe mechanisms of diseases associated with adverse functions of the immune system.
- CO 6 Apply immunologic techniques to solve certain clinical and research problems.

BHBT 304 B: MOLECULAR DIAGNOSTICS

Course Outcome:

Students who successfully complete this course will be able to:

- CO1: Have clarity about the molecular diagnostic aspects, its significance and goal.
- CO2: Develop understanding on various techniques used in the clinical diagnostic laboratory for the diagnosis of various pathogenic situations.
- CO3: Students will get an idea about the Quality assurance that needs to be followed in the molecular diagnostic lab.
- CO4: Understanding about the use of automation in diagnostic processes.

BHBT 305 A: BIOETHICS & BIOSAFETY

Course Outcome

Students who successfully complete this course will be able to:

- CO 1 Interpret basics of biosafety and bioethics and its impact on all the biological sciences and the quality of human life
- CO 2 Recognize importance of biosafety practices and guidelines in research
- CO 3 Comprehend benefits of GM technology and related issues
- CO 4 Recognize importance of protection of new knowledge and innovations and its role in business.

BHBT 305 B: BIOSTATISTICS

Course Outcome

Students who successfully complete this course will be able to:

- CO 1 Recognize the definition of statistics, its subject and its relation with the other sciences.
- CO 2 Restate the principal concepts about biostatistics.
- CO 3 Collect data relating to variable/variables which will be examined and calculate descriptive statistics from these data.
- CO 4 Identify data relating to variable/variables.
- CO 5 Identify convenient sample by using sampling theory.

BHBT401: RECOMBINANT DNA TECHNOLOGY

Course Outcome

Students who successfully complete this course will be able to:

- CO 1 Describe biocatalysis, pathway engineering, bioprocess control and downstream processing.

- CO 2 Demonstrate their ability to reason both inductively and deductively with experimental information and data.
- CO 3 Explain the theory and practice of recombinant DNA technology.
- CO 4 Select and apply experimental procedures to the spectrum of fields making use of biotechnology.

BHBT402: BIOPHYSICS & BIOANALYTICAL TECHNIQUES

Course Outcome

Students who successfully complete this course will be able to:

- CO 1 Explain the basic concepts and principles of physics and their applications to biological systems.
- CO 2 Apply problem-solving skills to practical problems within the life sciences.
- CO 3 Choose appropriate biophysical methods to characterize biological systems and appreciate their limitations.
- CO 4 Analyze complex issues in biophysics using modeling.
- CO 5 Use a variety of simulation programs, featuring data analysis and display, to derive conclusions about experimental situations.
- CO 6 Critically evaluate scientific and medical literature.
- CO 7 Organize and express ideas clearly and convincingly in oral and written forms.

BHBT403: DEVELOPMENTAL BIOLOGY

Course Outcome

Students who successfully complete this course will be able to:

- CO 1 Outline and compare the developmental stages which occur in a variety of animal phyla.
- CO 2 Explain the mechanisms which lead to cell determination.
- CO 3 Describe the evolutionary conservation of developmental mechanisms.
- CO 4 Generate a hypothesis from a set of observations and then design experiments to test the hypothesis.

BHBT 405 A: IPR AND ENTREPRENEURSHIP

Course Outcome

On completion of this unit of study, students should be able to:

- CO 1 Apply intellectual property law principles (including copyright, patents, designs and trademarks) to real problems and analyze the social impact of intellectual property law and policy
- CO 2 Work in teams, solve problems and manage time
- CO 3 Analyze ethical and professional issues which arise in the intellectual property law context
- CO 4 Write reports on project work and critical reflect on your own learning.

BHBT 405 B: MEDICAL MICROBIOLOGY

Course Outcome

On completion of this unit of study, students should be able to:

- CO 1 Understand mechanisms of infectious disease transmission, principles of aseptic practice, and the role of the human body's normal microflora.
- CO 2 Understand conceptual basis for understanding pathogenic microorganisms and the mechanisms by which they cause disease in the human body.
- CO 3 Understand opportunities to develop informatics and diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases.
- CO 4 Understand the importance of pathogenic bacteria in human disease with respect to infections of the respiratory tract, gastrointestinal tract, urinary tract, skin and soft tissue.
- CO 5 Understand the use of lab animals in medical field.

BHBT 501: ENVIRONMENTAL BIOTECHNOLOGY

Course Outcome

Students who successfully complete this course will be able to:

- CO 1 Understand various water testing parameters including TS, TDS, TSS, alkalinity, pH etc.
- CO 2 Understand oxygen demand indicating level of pollution in wastewater including chemical oxygen demand (COD) and biochemical oxygen demand (BOD).
- CO 3 Find heavy metals like nickel and chromium in water indicating water pollution.
- CO 4 Understand bioremediation strategies for degradation of heavy metals and dyes in textile effluent.
- CO 5 Understand concept of vermicomposting and biogas production.

BHBT 502: BIOPROCESS ENGINEERING

Course Outcome

Students who successfully complete this course will be able to:

- CO 1 Model and analyze simple bioreactor systems, including chemostats and enzyme batch reactors, using first principles models.
- CO 2 Analyze metabolic pathway models for application to chemostat reaction systems.
- CO 3 Design procedures from expression of foreign genes in E. coli using principles of cellular chemistry.
- CO 4 Develop a historical exposition of biotechnology.
- CO 5 Analyze batch bioreactor data.
- CO 6 Evaluate separations systems for cell separation and purification of intracellular and secreted compounds from bacterial and animal cell cultures.

BHBT 503 A: BIOINFORMATICS

Course Outcome

Students who successfully complete this course will be able to:

- CO 1 Describe the flow and regulation of biological information.
- CO 2 Describe the techniques used to collect sequence and expression data.
- CO 3 Identify appropriate biological databases for specific analyses.
- CO 4 Manipulate on-line resources appropriately.
- CO 5 Analyze gene expression and interpret its significance.
- CO 6 Manage bioinformatics tools.
- CO 7 Apply appropriate statistical methods to determine sequence similarities.

BHBT 503 B: ENZYMOLOGY

Course Outcome

Students who successfully complete this course will be able to:

- CO 1 define enzyme structure
- CO 2 define differences between enzymes and normal catalytic substances
- CO 3 recognize the catalytic substances explain chemical structure of enzymes
- CO 4 recognize the enzymes chemical structure
- CO 5 explain cofactor and coenzymes chemical structure
- CO 6 recognize chemical structures of biological cofactor and coenzymes.

BHBT 504 C: PLANT BIOTECHNOLOGY

Course Outcome

Students who successfully complete this course will be able to:

- CO 1 Explain the basics of the physiological and molecular processes that occur during plant growth and development and during environmental adaptations
- CO 2 Understand how biotechnology has been used to develop knowledge of complex processes that occur in the plant
- CO 3 Use basic biotechnological techniques to explore molecular biology of plants
- CO 4 Understand the processes involved in the planning, conduct and execution of plant biotechnology experiments
- CO 5 Explain how biotechnology is used for plant improvement and discuss the ethical implications of that use.

BHBT 601: TISSUE CULTURE TECHNOLOGY

Course Outcome

Students who successfully complete this course will be able to:

- CO 1 Grow, maintain, and propagate specific plant and animal cell types in a sterile environment.
- CO 2 Handle, store and identify cells in culture.
- CO 3 Count, identify and assess viability of cells by microscopic examination.
- CO 4 Identify the problems associated with growing, storing and identifying a wide range of different cell types.
- CO 5 Describe how cell culture can be used for in vitro studies and commercial applications.

BHBT 602: MICROBIAL TECHNOLOGY

Course Outcome

Students who successfully complete this course will be able to:

- CO 1 Isolate microorganisms from food, water and soil samples.
- CO 2 Understand microbial production of various metabolites.
- CO 3 Find pathogenic microorganisms from various samples including food water and soil.
- CO 4 Find kinetic characterization of various enzymes and their immobilization for further use.
- CO 5 Understand basic principle of fermentation and fermentative products.

BHBT 603 A: INDUSTRIAL FERMENTATION

Course Outcome

Students who successfully complete this course will be able to:

- CO 1 Fermenter design, different types of fermentations and the current trend of fermentation process in biotech-industry.
- CO 2 Evaluate factors that contribute in enhancement of cell and product formation during fermentation process.
- CO 3 Analyze kinetics of cell and product formation in batch, continuous and fed-batch cultures.
- CO 4 Understand fermentative production of various products including ethanol, vinegar, wine, single cell proteins and amino acids.

BHBT 603 B: ANIMAL DIVERSITY

Course Outcome

Students who successfully complete this course will be able to:

- CO 1 Provides students with an in-depth knowledge of the diversity in form, structure and habits of invertebrates.
- CO 2 Learn basics of systematics and understand hierarchy of different categories.
- CO 3 Learn diagnostic characteristics of different phyla through brief studies of examples.
- CO 4 Obtain overview of economically important invertebrates.
- CO 5 Classify all the invertebrate phyla up to class.

BHBT 603 C: PLANT DIVERSITY

Course Outcome

Students who successfully complete this course will be able to:

- CO 1 Describe the biological basis of plant classification.
- CO 2 Recognize the major plant families of North America by sight.
- CO 3 Recognize ecologically and economically important California plant species by sight.
- CO 4 Identify unknown plant species using dichotomous keys.
- CO 5 Employ diverse taxonomic resources for plant identification, including electronic and print media, reference materials, and herbarium collections.
- CO 6 Discuss current questions in plant evolution and classification.