Department of Biotechnology

Bachelor of Science in Biotechnology

Program Outcomes

POs:

[PO.1]. Knowledge: Understand the basic concepts, fundamental principles, and the scientific theories related to various scientific phenomena and their relevancies in the day-to-day life.

[PO.2]. Problem analysis: Analyzed the given scientific data critically and systematically and the ability to draw the objective conclusions.

[PO.3]. Instrumentation: Acquired the skills in handling scientific instruments, planning and performing in laboratory experiments.

[PO.4]. Communication skills: Developed various communication skills such as reading, listening, speaking, etc., which we will help in expressing ideas and views clearly and effectively.

[PO.5]. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

[PO.6]. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

[PO.7]. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

Department of Biotechnology

Program Specific Outcomes

PSOs:

[PSO-1]- An expert in Biotechnology subjects' knowledge

[PSO-2]- An expert in Biotechnology practical skills.

[PSO-3]- Efficient researcher using biotechnology practical skills.

[**PSO-4]-** Development of own entrepreneur skills in biotechnology industry

[**PSO-5]-**Well versed in the field of various biotechnology fields (medical, microbial, agricultural, environmental, plant and animal).

Semester I

Department of Biotechnology

Subject: Biochemistry
Code: BTG21001
4 Credits | Semester 1

Course Outcomes: At the end of the course, students will be able to:

CO1: Have foundational understanding of the chemical constituents of cells, the basic units of living organisms.

CO2: Explanation of various types of weak interactions between the biomolecules.
CO3: Know how the simple precursors give rise to large biomolecules such asproteins, carbohydrates, lipids, nucleic acids.
CO4: Know about biocatalyst and their role
CO5: Know how biomolecules metabolize to produce energy and other precursor molecules.
CO6: Ability to critically evaluate, interpret and correlate the biochemical information

Subject: Cell Biology
Code: BTG21002
4 Credits | Semester 1

Course Outcomes: At the end of the course, students will be able to:

CO1: Recall structure and function of a prokaryotic and eukaryotic cells (both plant and animal cells)

CO2: Understand structure of different cell organelles such as mitochondria, nucleus, Golgi apparatus etc.

CO3: Understand molecular basis of cancer and agents that cause cancer

CO4: Comprehend regulation of receptor expression and function.

CO5: Understand expression and regulation of cell receptor and their function.

Subject: Core Practical
Code: BTG21003
4 Credits | Semester 1

Course Outcomes: At the end of the course, students will be able to:

CO1: Understand calorimetry work principle and titration principle

CO2: Perform estimation of biomolecules

CO3: Understand the process of cell division (Mitosis and Meiosis) principle and its various stages

CO4: Perform Plasmolysis and de-plasmolysis experiment

CO5: Able to identify structure of the prokaryotic cell and eukaryotic cell

CO6: Acquire knowledge about Microtome: Fixation, block making, section cutting, double staining of animal tissue.

Subject: Environment Sciences
Code: MGT21010
2 Credits | Semester 1

Course Outcomes: At the end of the course, students will be able to:

CO1: Describe the ecosystems and their components

CO2: Understand the concept of sustainability and sustainable development

CO3: Explain International Agreement on Environmental Management

CO4: Attain knowledge about Human Population Growth and its effects on the environment

CO5: Understand the concepts of Biodiversity, Biosphere reserves, National Parks and sanctuaries

CO6: Gain Knowledge of renewable and non-renewable energy resource

Subject: Entrepreneurship & small business

Code: MGT21070

2 Credits | Semester 1

Course Outcomes: At the end of the course, students will be able to:

CO1: Understand entrepreneurship, know about entrepreneur and their characteristics

CO2: Attain knowledge about various types of business organizations and size of business organizations

CO3: Know about different Entrepreneurship development programs

CO4: Understand the differences between business ideas and opportunities

CO5: Attain knowledge about project identification and appraisal.

CO6: Acquire knowledge about small scale industries

Subject: English

Code: ENG21025

2 Credits | Semester 1

Course Outcomes: At the end of the course, students will be able to:

CO1: Use the formal way of presentation & comprehension of simple words and phrases used in the day-to-day context.

CO2: Appreciate the different aspects related to English literature.

CO3: Acquire basic knowledge about English Grammar, used in Presentation and conversation.

CO4: To speak & write clearly and correctly in English

Semester II

Department of Biotechnology

Subject: Mammalian physiology
Code BTG22004
4Credits | Semester 2

Course Outcomes: At the end of the course, students will be able to:

CO1: Understand the physiology of respiration

CO2: Attain knowledge about physiology and mechanism of digestion & absorption

CO3: Understand the Circulation of body fluid (Blood and Lymph), Role of Hearth and blood vessels in blood circulation

CO4: Acquire knowledge about mechanism of blood Coagulation

CO5: Understand physiology of muscle and role of muscle contraction in movement and locomotion.

CO6: Understand the concept of excretion and Osmoregulation

Subject: Plant Physiology
Code: BTG22005
2Credits | Semester 2

Course Outcomes: At the end of the course, students will be able to:

CO1: Understand the different types of cells, tissue differentiation and organization in plants

CO2: Understand significance of phenomena like diffusion, osmosis, plasmolysis, imbibition, Guttation, transpiration

CO3: Acquire knowledge about nitrogen cycle, fixation assimilation of Nitrogen in plants, nitrogen

CO4: Understand the mechanism of uptake of nutrients, mechanism of food transport

CO5: Attain knowledge about Plant hormones and their role in the growth of plants

CO6: Understand primary structure of shoot; root, secondary growth, leaf anatomy

Department of Biotechnology

Subject: Core Practical 2

Code: BTG22006

4Credits | Semester 2

Course Outcomes: At the end of the course, students will be able to:

CO1: Separate photosynthetic pigments by paper chromatography

CO2: Learn the process of opening & closing of stomata

CO3: Understand the mechanism of guttation in leaves by experiment

CO4: Experimentally demonstrate aerobic respiration in plant

CO5: Perform isolation of root nodules from a leguminous plants

CO6: Prepare stained mounts of anatomy of monocot and dicot's root, Stem & leaf.

Subject: Biotechnology and human welfare

Code BTG22007

4 Credits | Semester 2

Course Outcomes: At the end of the course, students will be able to:

CO1: Understand the role of Biotechnology in different sectors

CO2: Understand the application of biotechnology processes in Human Welfare

CO3: Understand the concept of interaction between plants and microorganisms

CO4: Acquire knowledge about biodegradable materials to protect environment from pollution

CO5: Attain the knowledge about DNA finger printing, gene therapy and Monoclonal antibodies.

Department of Biotechnology

Subject: Biotechnology and Human Welfare Practical

Code: BTG22008

2Credits | Semester 2

Course Outcomes: At the end of the course, students will be able to:

CO1: Understand fermentation processes to make different commercial products

CO2: Observe the plant parts (leaves and stems) infected with microbes

CO3: Perform quantitative estimation of residual chlorine in water samples

CO4: Isolate and analyze the DNA from different biological samples

CO5: Understand the Use of PCR for biological samples

Semester III

Subject: Genetics
Code BTG23009
4Credits | Semester 3

Course Outcomes: At the end of the course, students will be able to:

CO1: Comprehend and apply knowledge of genetics as it relates to a variety of topics including inheritance patterns, population and quantitative genetics, and mutation.

CO2: Discuss about Mendelian genetics, multiple allele and Various Epistasis

CO3: Understand in detail about chromosomal and gene mutation

CO4: Understand about various genetic disorders and their causes

CO5: Attain knowledge about Karyotyping and its application in the field of Genetics

Subject: General Microbiology
Code BTG22010
4Credits | Semester 3

Course Outcomes: At the end of the course, students will be able to:

CO1: Understand the diversified branches of microbiology

CO2: Describe the theoretical and practical aspects of microbial growth and physiology

CO3: Define the morphology and physiological characteristics of different groups of microorganisms

CO4: Understand the process of virus cultivation, phages and bacterial/yeast genetics

CO5: Acquire detailed knowledge about genome of various types of microorganism

Subject: Core Practical 3
Code BTG23011
4 Credits | Semester 3

Course Outcomes: At the end of the course, students will be able to do:

CO1: Solve Problems related to Mendelian Genetics in monohybrid and dihybrid cross

CO2: Explain Karyotyping with the help of photographs

CO3: Analyze autosomal and sex-linked disease using Pedigree charts.

CO4: Perform polyploidy induction in onion root tips by colchicines treatment.

CO5: Carry out Sterilization process (autoclave) techniques followed in microbiology laboratory

CO6: Isolate and Identify bacteria from different sources using different media for cultivation of bacteria/ fungi.

Subject: Chemistry
Code SCI23001
4Credits | Semester 3

Course Outcomes: At the end of the course, students will be able to:

CO1: Learn the concept of Stereochemistry, conformation and geometrical isomerism

CO2: Discuss relative and absolute configuration

CO3: Describe hydrogenation and hydro halogenation reactions

CO4: Demonstrate reactions of aldehydes and ketones with ammonia and its derivative

CO5: Understand aldol, cross aldol and cannizzaro reactions

CO6: Understand the reaction mechanism of halogenations of alkanes, allylic compounds and alkyl benzenes, elimination reaction

Subject: Chemistry-1 practical

Code SCI23002

2 Credits | Semester 3

Course Outcomes: At the end of the course, students will be able to:

CO1: Carry out experiments illustrating the principles of chemistry relevant to the study of science.

CO2: Measure molecular/system properties such as melting point and boiling point.

CO3: Prepare derivatives from organic compounds.

CO4: Construct molecular models

Subject: Bacteriology and Virology

Code BTG23012

4 Credits | Semester 3

Course Outcomes: At the end of the course, students will be able to:

CO1. Gain knowledge about the basic concepts of Bacteriology
CO2. Learn the bacteriology techniques for diagnosis
CO3. Gain knowledge about various bacterial gene transfer
CO4. Gain knowledge about the basic concepts of virology
CO5. Learn the virological techniques for diagnosis
CO6. Gain knowledge about various viral groups and viral treatment

Department of Biotechnology

Subject: Molecular Diagnostics

Code BTG23012

4 Credits | Semester 3

Course Outcomes: At the end of the course, students will be able to:

CO1: Understand Immunoassays, different enzyme available for immunoassays and immunohistochemically techniques

CO2: Acquire knowledge about Application of enzyme immunoassays

CO3: Understand the uses of monoclonal bodies in Immunoassays

CO4: Explain application of PCR in clinical microbiology

CO5: Understand different lab test in chemotherapy

CO6: Comprehend the Rapid diagnostic approaches and standardization of antigen and specific antibodies

Subject: Bacteriology and Virology Practical

Code BTG23013

2 Credits | Semester 3

Course Outcomes: At the end of the course, students will be able to:

CO1: Use Sterilization techniques, wet heat, dry heat, filter types, laminar flow chamber types

CO2: Isolate high titer of Bacteriophage.

CO3: Illustrate numeration of Bacteriophage in a sample by Plaque forming unit.

CO4: Carry out serological test for viral studies

CO5: Isolate Bacteriophage from sewage

CO6: Adjust microscope, understand Microscopy, learn about Microscope and its operations, components, Microscope types, Light sources, microscopic measurements and calibration

Subject Bioethics and Biosafety

Code

4 Credits | Semester 3

Course Outcomes: At the end of the course, students will be able to:

CO1: Interpret basics of Biosafety and bioethics and its impact on all the biological sciences and the quality of human life

CO2: Recognize importance of Biosafety practices and guidelines in research

CO3: Comprehend benefits of GM technology and related issues

CO4: Recognize importance of protection of new knowledge and innovations and its role in business

Semester IV

Department of Biotechnology

Subject Molecular Biology
Code BTG24015
4 Credits | Semester 4

Course Outcomes: At the end of the course, students will be able to:

CO1: Understand the concept of DNA replication, transcription and translation

CO2: Attain knowledge about DNA damage and various DNA repair mechanisms

CO3: Understand the mechanism of recombination in DNA

CO4: Elaborate the modern tools and techniques of molecular biology and isolation and identification of genes

CO5: Understand the biology and application of antisense technologies and biology of cancer

Subject Immunology
Code BTG24016
4 Credits | Semester 4

Course Outcomes: At the end of the course, students will be able to:

CO1. Understand the basic concept of innate and acquired immunity.

CO2. Acquire knowledge about immunoglobulin structures and diversity of antibodies, morphology and functions of various immune cells such as dendritic cells, macrophages, Neutrophils and their association with MHC molecules will be studied.

CO3. Acquire understanding of immunology and immune responses in response to various infectious and noninfectious diseases.

CO4. Gain knowledge about various kinds of vaccines and their action

Department of Biotechnology

Subject Core Practical 4
Code BTG23011
4 Credits | Semester 4

Course Outcomes: At the end of the course, students will be able to:

CO1: Isolate chromosomal and plasmid DNA from E. coli

CO2: Perform Qualitative and quantitative analysis of DNA using spectrophotometer

CO3: Carry out Restriction digestion of DNA

CO4: Prepare competent cell and transformation of competent cells.

CO5: Explain steps to carry out PCR process

CO6: Observe and identify the immune cells under microscope

Subject: Chemistry
Code: SCI24003
4 Credits | Semester 4

Course Outcomes: At the end of the course, students will be able to:

CO1: Understand concept of resonance in various inorganic compounds
CO2: Understand Intermolecular forces and their effect
CO3: Acquire knowledge about Transition elements
CO4: Clearly understand Lanthanides and actinides
CO5: Explain structural and stereoisomerism in complexes
CO6: Understand Co-ordination compounds in biological systems

Department of Biotechnology

Subject: Chemistry Practical
Code:
2 Credits | Semester 4

Course Outcomes: At the end of the course, students will be able to:

CO1: Prepare different solutions and the analysis of salt
CO2: Estimate different cations and anions
CO3: Perform separation of salts
CO4: Perform separation of Acid and Basic radicals from a salt mixture

Subject: Microbial Metabolism
Code: BTG24018
4 Credits | Semester 4

Course Outcomes: At the end of the course, students will be able to:

CO1: Apply the knowledge to understand the microbial physiology and to identify the microorganisms.

CO2: Comprehend the concept of various pathways in the microbial metabolism
CO3: Understand the regulation of biochemical pathway in microorganisms
CO4: Attain knowledge about possible process modifications for improved control over microorganisms for microbial product synthesis.

Subject: Microbial Metabolism Practical

Code: BTG24019

2 Credits | Semester 4

Course Outcomes: At the end of the course, students will be able to:

CO1: Prepare liquid and solid media for growth of microorganisms.

CO2: Isolate, perform and maintain organisms by plating, streaking and serial dilution methods.

CO3: Isolate pure; microbial cultures from soil and water

CO4: Carry out direct microscopes counting of bacteria.

CO5: Study Motility by hanging drop techniques.

CO6: Do Microscopic examination of bacterial, yeast and molds

Subject: Industrial Fermentation

Code: BTG24020

4 Credits | Semester 4

Course Outcomes: At the end of the course, students will be able to:

CO1: Demonstrate knowledge about biological and biochemical technology, with a focus on biological products, the design and operation of industrial practices.

CO2: Evaluate factors that contribute in enhancement of cell and product formation during fermentation process.

CO3: Analyze kinetics of cell and product formation in batch, continuous and fed-batch cultures

CO4: Differentiate the rheological changes during fermentation process

Department of Biotechnology

Subject: Biostatistics
Code: **BTG24039**
4 Credits | Semester 4

Course Outcomes: At the end of the course, students will be able to:

CO1: Describe the roles biostatistics play in the domain of public health.

CO2: Apply basic statistical concepts commonly used in public health and health Sciences

CO3: Demonstrate basic analytical techniques to generate results

CO4: Interpret results of commonly used statistical analyses in written summaries

Semester V

Department of Biotechnology

Subject: Bioprocess Technology
Code: BTG25021
4 Credits | Semester 5

Course Outcomes: At the end of the course, students will be able to:

CO1: Understand various types of bioprocesses carried out in industry and various types of bioreactors

CO2: Understand the application and functioning of bioreactors system, computer aided Bioreactors

CO3: Understand upstream, downstream process for different bioprocesses, and their control

CO4: Acquire basic understanding of various parameters for mass transfer

Subject: Recombinant DNA Technology
Code: BTG25022
4 Credits | Semester 5

Course Outcomes: At the end of the course, students will be able to:

CO1. Understand the tools and techniques of genetic engineering-DNA manipulation enzymes, genome and transcriptome analysis and manipulation tools, gene expression regulation, production and characterization of recombinant proteins.

CO2. Acquire knowledge about applications of genetic engineering in biological research.

CO3. Perform basic genetic engineering experiments.

CO4. Acquire knowledge of advances in biotechnology- healthcare, agriculture and environment cleanup via recombinant DNA technology.

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Subject: Core Practical-5
Code: BTG25023
4 Credits | Semester 5

Course Outcomes: At the end of the course, students will be able to:

CO1: Understand the parts and operation of the fermenter and their use for the production of commercial products

CO2: Understand the concept of various downstream processes

CO3: Isolate chromosomal and plasmid DNA from E. *Coli*

CO4: Carry out restriction digestion of DNA

CO5: Make competent cell and Transformation of competent cells.

CO6: Perform amplification of DNA by a thermocycler

Subject: Bioinformatics
Code: BTG25024
4 Credits | Semester 5

Course Outcomes: At the end of the course, students will be able to:

CO1. Understand and describe and use the biological databases, perform structured query and analyze and discuss the results in biologically significant way.

CO2. Attain knowledge about the use of BLAST, FASTA and use NCBI site for, *in silico* molecular biology

CO3. Understand principle, algorithm and different methods of sequence alignments as well as execute alignments to address research problems

CO4. Perform wide variety of bioinformatics tools and software and apply these to conduct basic bioinformatics research and thus develop platform for molecular biology experiments

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Subject: Bioinformatics Practical

Code: BTG25025

2 Credits | Semester 5

Course Outcomes: At the end of the course, students will be able to:

CO1: Utilize information from SNP databases at NCBI and other sites

CO2: Learn the application of OMIM database

CO3: Detect Open Reading Frames using ORF finder

CO4: Work on Proteomics 2D PAGE database

CO5: Analyze the Protein localization by using different software

Subject: Animal Biotechnology

Code: BTG25026

4 Credits | Semester 5

Course Outcomes: At the end of the course, students will be able to:

CO1: Understand the concept of gene transfer technologies for animals and animal cell lines.

CO2: Attain knowledge about application of biotechnology in animal diseases control

CO3: Understand basic principles and techniques in genetic manipulation and genetic engineering.

CO4: Acquire knowledge about genetic modification in the field of Medicine and health care: Gene therapy

CO5: Understand the techniques and problems, both technical and ethical, in animal and human cloning.

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Subject: Animal Biotechnology Practical

Code: BTG25027

2 Credits | Semester 5

Course Outcomes: At the end of the course, students will be able to:

CO1: Use Sterilization techniques for glassware and media

CO2: Prepare media for animal biotechnology

CO3: Use Lab sterilization processes

CO4: Isolate DNA from animal tissue

CO5: Prepare Minimal Essential Growth medium

CO6: Isolate lymphocytes for culturing

Semester VI

Subject: Bioanalytical tools

Code: BTG26028
4 Credits | Semester 6

Course Outcomes: At the end of the course, students will be able to:

CO1: Understand the basic principle of different Bioanalytical techniques

CO2: Know the separation techniques of DNA and protein

CO3: Know about absorption and emission spectroscopy

CO4: Comprehend various aspects related to chromatography

Subject: Bioanalytical tools Practical

Code: BTG26029
2 Credits | Semester 6

Course Outcomes: At the end of the course, students will be able to:

CO1: Study relation between absorbance and percentage transmission using spectrophotometer

CO2: Separate different types of amino acids by paper chromatography (ascending method)

CO3: Separate the proteins by SDS-polyacrylamide gel electrophoresis.

CO4: Identify the lipids in a given sample by TLC

CO5: Verify the validity of Beer"s law and determine the molar extinction coefficient of NADH

CO6: Separate the plant pigments by adsorption column chromatography

Department of Biotechnology

Subject: Genomics and Proteomics
Code: BTG26030
4 Credits | Semester 6

Course Outcomes: At the end of the course, students will be able to:

CO1: Comprehend introduction and scope of genomics and proteomics

CO2: Know about Protein sequencing methods

CO3: Understand Genome sequencing, human genome project

CO4: Analyze Genomic databases and genome analysis

CO5: Analysis of proteomes

CO6: Understand Mass spectrometry based methods for protein identification

Subject: Genomics and Proteomics Practical
Code: BTG26031
2 Credits | Semester 6

Course Outcomes: At the end of the course, students will be able to:

CO1: Use SNP databases at NCBI and other sites

CO2: Use OMIM database

CO3: Detect Open Reading Frames using ORF finder

CO4: Illustrate Proteomics 2D PAGE database

CO5: Analyse Protein localization by using different software

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Subject: Environmental Biotechnology
Code: BTG26032
4 Credits | Semester 6

Course Outcomes: At the end of the course, students will be able to:

CO1. Evaluate the potential of biodegradation of organic pollutants, taking microbial and physical/chemical environments, as well as the chemical structure of the compound itself, into consideration

CO2. Understand the phenomenon of phytoremediation for the decontamination of soil and water, wetlands as treatment processes, biofilms/biofilters for vapor-phase wastes, and composting

CO3. Learn about the environmental quality evaluation, monitoring, and remediation of contaminated environments

CO4. Learn about the use of biosensors in environmental analysis, environmental engineering.

Subject: Environmental Biotechnology Practical
Code : BTG26033
2 Credits | Semester 6

Course Outcomes: At the end of the course, students will be able to:

CO1: Calculate Total Dissolved Solids (TDS) of water sample.

CO2: Examine Bacterial count of Water by MPN Method

CO3: Calculate BOD of water sample

CO4: Calculate COD of water sample

Subject: Plant Biotechnology
Code: BTG26034
4 Credits | Semester 6

Course Outcomes: At the end of the course, students will be able to

CO1. Learn the principals and technical advances behind the in-vitro culture of plant cells and rDNA techniques

CO2. Learn the applications of plant transformation for improving the productivity and performance of plants under biotic and abiotic stresses

CO3.Understand the use of antisense technologies for improvement of crop plants

CO4. Know about plant growth promoting bacteria

Subject: Plant Biotechnology Practical
Code: BTG26035
2 Credits | Semester 6

Course Outcomes: At the end of the course, students will be able to:

CO-1: Prepare simple growth nutrient (Knop's medium), full strength, half strength, solid and liquid.

CO-2 Prepare complex nutrient medium

CO-3 Select, Prune, sterilize and prepare an explant for culture.

CO-4 Understand Significance of growth hormones in culture medium.

CO-5 Perform various steps of Micro propagation using explant.

Department of Biotechnology

Subject: Project
Code: BTG26036
4 Credits | Semester 6

Course Outcomes: At the end of the course, students will be able to

CO-1: Ability to work in team and carry out research thereby forming hypotheses

CO-2: Think of novel ideas based on previous work

CO-3: Collect data from various sources and analyze data using statistical software

CO-4: Conversant with data presentation

CO-5: Be well versed with lab chemicals