Department of Biotechnology
Bodoland University
M.Sc Course

Programme Specific Outcomes:

PSO 1: Students shall be able to acquire knowledge on the fundamental concepts of core areas of biotechnology such as cell biology, molecular biology, genetics and biochemistry.

PSO 2: The programme is aimed to offer a broad understanding of the applied subjects of genetic engineering, microbiology, immunology, bioinformatics, stem cell, food biotechnology and environmental biotechnology.

PSO 3: Students shall earn the experience and learning for implementing problem solving approach and research aptitude in the field of biotechnology.

PSO 4: Students shall experience hands-on training on modern tools and techniques, gain the ability in equipment handling and other basic laboratory skills relevant to biotechnology

PSO 5: Provide an environment wherein the students have the opportunity to develop their entrepreneurial ideas and encourage them for start ups and bio-enterpreneurship.

PSO 6: Students will be able to prepare proposal for biotechnology relevant projects with state of-the-art design, principle, methodology, experiments, data collection, analysis and interpretation for successful implementation

SEMESTER-1

BIT-101: Biochemistry

After successful completion of this course, students will be able to:

CO1: Develop advance level of knowledge and understanding of aspects of physical, chemical and biological properties of biomolecules.

CO2: Learn principles that govern the structure and functions of macromolecules and their participation in living cells.

CO3: Understand the processes of energy production and utilization for various biological functions.

CO4: Have an insight on the structure and metabolic and catabolic pathways of amino acids.

CO5: Gain knowledge on informational macromolecules.

BIT-102: MICROBIOLOGY

After successful completion of the course, the student learners are expected to be able to -

CO1: Have a thorough understanding of microbial taxonomy including the classical and modern concepts of classification and also the basic idea of Bergey's manual for bacterial classification. The student learner should also have the knowledge of diversity amongst the various microbial groups.

CO2: Have a clear understanding about the culturing of microorganisms including obtaining pure culture, methods of growth estimation, molecular techniques for microbial diversity and different microscopic techniques.

CO3: Have a clear concept on microbial growth, nutrition and the mechanism of transduction, conjugation, recombination in microorganisms.

CO4: Have a detail knowledge about microbial interactions, infection of pathogenic microorganisms and identify ways to control the infection.

CO5: Have a basic idea about the vast role of microorganism in the environment and the application of their product in various industries.

BIT-103: Cell & Development Biology

After successful completion of the course, the student learners are expected to be able to -

CO1: Students shall get an insight into the structure and organization of the cell and the cellular organelles.

CO2: Students shall obtain knowledge about various activities taking place at the cellular level such as cell-cell interactions, cellular transportations, cell-communications and cell-signaling.

CO3: Learn about the cell cycle and its regulation.

CO4: Students shall learn about the various stages of development.

BIT-104: Genetics

After successful completion of the course, the student learners are expected to be able to -

CO1: Understand the structure of the human genome and impact of genetic variations.

CO2: Comprehend evolutionary genetics and understand genetic structure.

CO3: Understand basic techniques used in genetics and association studies.

CO4: Gain knowledge on molecular identification and classification techniques of comparative genomics.

BIT-105: Practical

After completing this course, the students will be able to-

CO1: Prepare Stock solutions, working solutions and buffers

CO2: Analyze glucose, protein, cholesterol, phenols, flavonoids concentration in unknown samples using standard graph.

CO3: Demonstrate the separation of amino acids using Thin layer Chromatography

CO4: Illustrate enzyme kinetics.

CO5: Isolate microorganisms, prepare pure culture, differentiate between gram positive and gram negative bacteria, screen amaylase producing bacteria and analyze water quality.

CO6: Illustrate bacterial Growth curve.

CO7: Perform histochemical techniques like microtomy and staining of cell organelles.

CO8: Demonstrate the isolation of egg embryo, estrus cycle and ovariectomy.

BIT-106E: Intellectual Property Rights

After completing this course-

CO1: Students shall get introduced to the fundamental aspects of Intellectual Property Rights.

CO2: Students shall understand the importance of IP.

CO3: Students shall understand the statutory provisions of different forms of IPR in simple forms.

CO4: Students learn the procedure of obtaining different IPs.

CO5: Pave the way for the students to catch up Intellectual Property(IP) as an career option in-

a. R&D IP Counsel
b. Government Jobs – Patent Examiner c. Private Jobs
c. Patent agent and Trademark agent

CO6: Entrepreneur

SEMESTER-2

BIT-201: Immunology

On completion of this course, students will be able to:

CO1: Explain the structural features of components of immune system as well as their functions.

CO2: Elucidate the development of immune system components and mechanisms by which our body elicits immune response against bacterial, viral or parasitic infection.

CO3: Describe the mechanism of antigen-antibody interactions.

CO4: Gain insights into clinical aspects of immunology and immunological techniques.

CO5: Demonstrate immunological aspects related to human diseases.

BIT-202: MOLECULAR BIOLOGY

After successful completion of the course, the student learners are expected to be able to -

CO1: Have a conceptual knowledge about DNA as a genetic material, Structure and function of RNA, the concept of central dogma and know the importance of genetic code and Wobble hypothesis.

CO2: Have an understanding about the properties, structure and function of Transposon and Retrotransposons, IS Elements, Multigene families.

CO3: Have thorough understanding of the underlying molecular mechanism of Transcription, translation and replication in prokaryotes and eukaryotes.

CO4: Have a complete concept on regulation of gene expression in prokaryotes and eukaryotes.

CO5: Explain the various tools and techniques of molecular biology viz. chromosome walking, primer walking, contig assembly, restriction mapping, chromosome jumping etc.

CO6: Have a thorough idea about different techniques for analysis at the level of transcription, translation and interaction between DNA-protein.

BIT-203: Genetic Engineering

CO1: Students shall learn about the various approaches of genetic engineering techniques used in biological researches.

CO2: Students shall learn about the utilization of manipulating enzymes, vectors used in gene cloning and the strategies of gene cloning and sequencing.

CO3: Students shall get elaborate knowledge on the concept of expression cloning and other related techniques that aid in recombinant-DNA technology.

BIT-204: Biostatistics and Bioinformatics

After Successful Completion of this Course, students shall be able to:

CO1: Learn data organization, summarization and analysis and demonstrate skills in interpreting and communicating the results of statistical analysis.

CO2: Gain knowledge on programming languages used in bioinformatics.

CO3: Gather information on bioinformatics resources and databases and know the usage of various biological databases.

CO4: Know about various sequences comparison methods.

CO5: Comprehend the basis of protein structure determination.

CO6: Understand the techniques used in protein modelling.

CO7: Know the techniques and applications of computational proteomics.

BIT-205: Practicals

After successful completion of this course, the students will be able to

CO1: Perform blood group typing, serological test, ELISA test and isolate antibody.

CO2: Isolate and quantify cell DNA

CO3: Demonstrate the process of PCR, restriction enzyme digestion and, SDS PAGE.

CO4: Perform statistical measures using computer packages

CO5: Learn to retrieve and analyse data using bioinformatics tools

BIT-206: Mushroom Technology and allied Science

After successful completion of the course, the student learners are expected to be able to -

CO1: Gain complete knowledge on mushroom culture and production techniques.

CO2: Acquire knowledge on processing, packaging, storage and quality management of mushroom products.

CO3: Demonstrate hydroponics culture.

CO4: Execute rose and orchid culture.

CO5: Get introduced to pearl culture, seri culture, apiculture, prawn culture and tissue culture techniques.

SEMESTER-3

BIT 301: PLANT BIOTECHNOLOGY

After successful completion of the course, the student learners are expected to be able to -

CO1: Have a clear theoretical concept on micropropagation, tissue culture media, sterilization techniques and different techniques for culturing shoot tip, embryo, pollen, anther and ovary etc. and developing haploids, hybrids and homozygous lines.

CO2: Have an understanding about the different plant transformation terms and technology viz. Ti-plasmid& Ri-plasmid, binary vectors, vector-less DNA transfer, promoters for plant transformation and chloroplast transformation.

CO3: Have a concept on the application of plant transformation technologies on developing herbicide resistance, insecticide resistance, disease resistance, nematode resistance and for increased productivity and performance.

CO4: Understand and apply the knowledge of transformation technologies for the production and purification of industrially significant products from genetically engineered plants.

CO5: Explain and apply the knowledge of recombinant DNA technology viz. RAPD, SSCP, SCAR, QTL mapping etc. for plant breeding. Also have a clear concept on techniques involved in germplasm conservation.

BIT- 302: Animal Biotechnology

After successful completion of the course, the student learners are expected to be able to –

CO1: Have an understanding of animal cell culture laboratory requirements and management.

CO2: Get an idea to prepare media and reagents for animal cell culture.

CO3: Gain insights into the concepts and techniques of animal cell and tissue culture

CO4: Describe the applications of animal cell culture in cell cloning, drug testing, toxicity test and in production of vaccines and pharmaceutical proteins.

CO5: Understand various techniques of *in vitro* fertilization and embryo transfer.

BIT-303: Analytical Techniques

On completion of this course, students should be able to

CO1: Understand the basics of microscopy, polymerization and DNA fingerprinting techniques.

CO2: Understand the principle, theory, methods and applications of chromatography and electrophoresis.

CO3: Describe the principles of centrifugation and spectrometry and associated methods to isolate and characterize different biomolecules.

CO4: Understand the theory of radioactivity and radioactivity measurements and other advanced analytical as well as preparatory techniques in biotechnology laboratories.

BIT-304: Toxicology

CO1: Students shall understand the basic principles of toxicology.

CO2: Students shall acquire knowledge on the core concepts of the science of toxicology, including hazard identification, exposure assessment, dose-response assessment and an understanding of the mechanisms of action and effects of toxic chemicals at multiple levels of biological organization.

CO3: Obtain understanding of the different types of toxic effects caused by harmful chemicals on the body.

CO4: Have an elaborate learning on the methods of toxicity tests.

CO5: Inspire students to identify problems and matters that pertains to toxicological research.

BIT-305: Practical

After successful completion of this course, the students will be able to

CO1: Prepare media for plant tissue culture.

CO2: Perform micro propagation, embryo culture, propagate callus and prepare artificial seeds.

CO3: Prepare animal cell culture media.

CO4: Culture bone marrow cells.

CO5: Illustrate ovulation in mammalian ovary

CO6: Demonstrate PCR reaction

CO7: Construct standard curve using Beer-Lambert law

CO8: Prepare TLC plates.

BIT-306: Mushroom Production, Vermicompost And Value Added Products

After successful completion of the course, the student learners are expected to be able to –

CO1: Get basic idea on fungi, basically mushrooms, their types, nutritional value, medicinal values and applications.

CO2: Demonstrate mushroom cultivation techniques.

CO3: Explain the principle and background of vermiculture.

CO4: Identify and rear earthworm for vermicomposting.

CO5: Develop vermicompost and analyse the nutritional composition of vermicompost for plants.

CO6: Understand disease and pest management and formulate value added products from mushroom.

CO7: Produce mushroom spawn.

SEMESTER-4

BIT-401: Computational Biology

CO1: Develop an understanding of basic theories of internet use.

CO2: Collect sequence data and store them in sequence laboratories using different online/offline computational tools.

CO3: Perform sequence alignment using various multiple sequence alignment techniques.

CO4: Predict secondary structures of biomolecules using computational tools.

CO5: Carry out phylogenetic analysis and interpret phylogenetic relationships.

CO6: Search databases for sequence similarities using various computational programming methods.

CO7: Gain working knowledge on gene prediction methods

BIT-402: Computational Biology

CO1: Demonstrate the basic structural components of protein

CO2: Predict protein secondary structures

CO3: Elucidate tertiary structures of proteins.

CO4: Explain the basics of proteomics.

CO5: Gain insights into genome analysis techniques.

CO6: Develop a clear concept on functional genomics

CO7: Gain working knowledge on various molecular modelling and drug designing techniques

BIT-404: Computational Biology

CO1: Use various available software and resources for computational analysis of biological sequences.

CO2: Design specific primers

CO3: Collect or retrieve DNA sequences and analyze them using sequence alignment tools.

CO4: Use phylogenetic analysis tools and construct phylogenetic trees.

CO5: Retrieve protein sequences and perform homology modeling.

CO6: Utilize molecular visualization and 3D structure visualizing tools.

CO7: Gain insights into utility of online bioinformatics tools.

CO8: Perform molecular docking through use of docking tools.

BIT-401: Stem Cell and Molecular Biology

After successful completion of this course, students will be able to:

CO1: Describe the characteristics of stem cells and the different types of stem cells.

CO2: Gain an understanding of stem cell regeneration techniques.

CO3: Understand basic biology/mechanisms of pluripotency, self-renewal of stem cells and epithelial stem developmental concepts.

CO4: Elaborate epigenetic mechanisms controlling mesoderm specifications.

CO5: Understand the reproductive biology of germ and somatic stem cells.

BIT-402: Stem Cell and Molecular Biology

After successful completion of this course, students will be able to:

CO1: Understand basic biology of mesodermal differentiation, hematopoietic stem cell trafficking and neural stem cell microenvironment concepts.

CO2: Describe the immunological aspects of stem cells in diseases and therapy.

CO3: Gain knowledge on stem cells tissue engineering techniques and their applications.

CO4: Obtain information on therapeutic approaches generated through use of stem cells for medical applications

BIT-404: Stem Cell and Molecular Biology

After successful completion of this course, students will be able to:

CO1: Understand the isolation process and cultivation of embryonic stem cells.

CO2: Generate parthenogenetic embryos in goat and cryopreserve of goat oocytes

CO3: Isolate and prepare metaphase plates of lymphocyte

CO4: Amplify OCT gene

CO5: Stain and count spermatozoa

CO6: Prepare fibroblast culture and feeder layer.

BIT 401: INDUSTRIAL FOOD BIOTECHNOLOGY

After successful completion of the course, the student learners are expected to be able to -

CO1: Understand the role of biotechnology in food industry, processes involved in production of enzymes and chemicals used in food industry. Have a solid base on the idea of enzyme immobilization and their application in the food industry. Appreciate how microbiology is

applied in manufacture of industrial products. Know how to source for microorganisms of industrial importance from the environment.

CO2: Have a clear concept on the idea of role of microorganisms in food spoilage and food fermentation. The student learner should also be able to explain the types of food preservation techniques i.e., classical as well as modern.

CO3: Have an idea about different fermented foods and beverages, their nutritional quality and also safety.

CO4: Have a thorough knowledge of SCP and different microorganisms and substrates involved in the process.

CO5: Know the regulatory bodies in food industry and their associated regulations and standard operating procedures.

CO6: Apply the theories and principles of food microbiology in practical, real-worldsituations and problems.

BIT 402: INDUSTRIAL FOOD BIOTECHNOLOGY

After successful completion of the course, the student learners are expected to be able to -

CO1: Get equipped with the theoretical and practicalknowledge about design of bioreactors,the different types of fermentation processes.

CO2: Have a thorough knowledge on the factors affecting growth and production, heat transfer, oxygen transfer.

CO3: Understand the rationale in medium formulation & design for microbial fermentation, sterilization of medium and air.

CO4: Comprehend the techniques and the underlying principles in downstream processing such as purification, storage and packing.

CO5: Have a concept on the application of nanotechnology in food processing.

BIT 403: PRACTICAL (INDUSTRIAL FOOD BIOTECHNOLOGY)

After successful completion of the course, the student learners are expected to be able to -

CO1: Learn various methods for the isolation, detection and identification of microorganisms in food and employ in industries.

CO2: Identify the various methods to control thedeterioration and spoilage of food.

CO3: Use of standardmethods and procedures for the microbiological analysis of food.

CO4: Implement and follow the standard operating procedures in the food industry in upstream as well as downstream processing.

BIT-401: Environmental Biotechnology

CO1: Students shall understand the basic concept of environment and also the issues related to the environment.

CO2: Understand the role of biotechnology in the protection and management of the environment.

CO3: Acquire knowledge on how biotechnology is useful for waste water treatment and managing air and soil pollution.

CO4: Understand the basic concept and definition of biodiversity, including the strategies of biodiversity conservation.

CO5: Learn about Integrated Pest Management and the role of biopesticides and biofertilizers. Students shall also get introduced to the concept of bioenergy.

BIT-402: Environmental Biotechnology

CO1: Students shall understand the concept of bioremediation and phytoremediation which are important tools of biotechnological approach for managing environmental pollution.

CO2: Students shall understand the concept of Xenobiotics and its various types. They shall also learn about the phenomenon of biotransformation of xenobiotics and its significance.

CO3: Students shall learn about the concept and technique of bioprospecting and its importance.

CO4: Student shall learn about cryopreservation technique and obtain elaborate knowledge on the protocols for animals, plants and microbial cells.

CO5: Students shall get introduced to IPR and about patenting of biological materials.

BIT-404: Environmental Biotechnology

CO1: Students shall have practical experience for detecting coliforms for determining purity of potable water

CO2: Learn the procedures of determining TotalSolids,SuspendedSolids&DissolvedSolids, COD, BOD and Sulphate in Waste Water.

CO3: Acquire experience in lab scale production of biopesticide, biofertilizer and vermicompost.

CO4: Learn to isolate bacteria with Xenobiotic-degrading properties, bio-surfactant producing and Rhizobia.

CO5: Learn to estimate soil enzyme activities- phosphatase/dehydrogenase/catalase/amidase.

BIT-403: Research Methodology

At the end of this course, the students should be able to:

After successful completion of the paper, each student is expected to-

CO1: Select and define appropriate research problem and Identify appropriate research topics.

CO2: Perform literature reviews using different print and online databases and prepare American Psychological Association (APA) formats for citations of print and electronic materials for future manuscripts prepared by them.

CO3: Describe sampling methods, measurement scales and instruments, and appropriate uses of each.

CO4: Familiarize with standard data collecting methods used in research.

CO5: Interpret data and write research report and thesis.

CO6: Write a research proposal.

Dissertation

By the end of the course, the student will be able to:

CO1: Recognize and refine an appropriate research question.

CO2: Identify an appropriate research topic.

CO3: Apply proper research design to the question, and select suitable methodology for the research work.

CO4: Discuss ethical dimensions for research and obtain the appropriate ethical approval if needed.

CO5: Manage, organize and interpret research data.

CO6: Present research findings in an appropriate written format.