Criterion-II (Teaching Learning and Evaluation)

Department of Biotechnology

Course objectives

- To impart an ability to apply biotechnology skills (including molecular & microbiology, immunology & genetic engineering, bioprocess & fermentation, enzyme & food technology and bioinformatics) and its applications in core and allied fields.
- To provide students with the concepts and research approaches for their higher career in the field of biotechnology and develop their scientific interest.
- To impart in-depth practical oriented knowledge to students in various thrust areas of biotechnology, so as to meet the demands of industry and academia.

Learning outcomes of BSc Biotechnology (Hon)

Semester I

BIT-HC-1016 Biochemistry & Metabolism

1. Introduction to Biochemistry
2. Structures and functions of Proteins, Carbohydrates, Lipids and nucleic acids
3. Carbohydrate metabolism
4. Bioenergetics and thermodynamics
5. Practical experiments for better understanding of the theory part

BIT-HC-1026 Cell Biology

1. Organization and functions of cell and its organelles.
2. Signal transduction and apoptosis
3. Practical experiments on cell structures, membrane functions, cell divisions; study of tissues and cell fractions.

ENG-AE-1014 English

1. Communicative English.

BIT-HG-1036 Biotechnology & Human Welfare

1. Protein engineering for different industries.
2. Plant-microbe interaction and stress response in plants, qualitative improvement of livestock.
3. Inorganic and organic pollutants, biodegradation, bioremediation, bioplastics, biopolymers and bio-surfactants
4. Biotechnology in forensic science and criminology
5. Biotechnology in modern medicine

Semester II

BIT-HC-2016 Mammalian Physiology

In this paper students will have a clear understanding on,

1. Digestion and Respiration
2. Circulation
3. Muscle physiology and osmoregulation
4. Nervous and endocrine coordination

BIT-HC-2026 Plant Physiology

In this paper students will have a clear understanding on
1. Anatomy of Plants
2. Plant water relations and micro & macro nutrients
3. Carbon and nitrogen metabolism
4. Growth and development
5. Practical experiments on plant anatomy and physiology

ENV-AE-1014 EVS
In this paper students will have a clear understanding on
Basics of environmental studies and different issues related to it.

BIT-HG-2046 Developmental Biology
In this paper students will get a clear understanding on,
1**.** Gametogenesis and Fertilization
2. Early embryonic development
3. Embryonic Differentiation
4. Organogenesis

Semester III

BIT-HC-3016 Genetics
In this paper students will get a clear understanding on,
1. History and Mendelian genetics
2. Non allelic interactions, Chromosome and genomic organization
3. Chromosome and gene mutations
4. Sex determination and sex linkage
5. Sex determination and sex linkage; Extra-chromosomal inheritance
6. Practical experiments for better understanding of the theories.

BIT-HC-3026 General Microbiology
In this paper students will get a clear understanding on,
1**.** An introduction to microbiology and its underlying principles
2. Functional morphology of the microbial cell
3. Microbial nutrition, nutritional categories, methods of isolation and preservation
4. Microbial growth, generation, metabolism
5. Control of microorganisms and microbes in different environments; water and food microbiology, fermentation, food preservation.
6. Experiments on sterilization; isolation and characterization m, staining and enumeration of microbes.

BIT-HC-3036 Chemistry-I
In this paper students will get a clear understanding on,
1. Atomic structure, bonding and molecular structure, general organic chemistry and aliphatic hydrocarbons.
2. Practical experiments for better understanding of the theory part

BIT-SE-3014 Enzymology
In this paper students will get to know about,
1. Enzyme and enzyme specificity
2. Isolation, crystallization, purification and analysis of enzymes; Enzyme classification; Enzyme substrate complex; Kinetics
3. Enzyme inhibition and mechanism of enzyme actions; enzyme regulation
4. Special enzymes and enzyme technology
5. Experiments on purification, assay and characterization of enzyme; quantification of protein.

BIT-HG-3016 Bioethics and Biosafety

This paper will clear all doubts on

1. Indian Patent Law and IPR

2. Bioethics and Biosafety measures

3. Proxy filing of patents, planning of establishing industries, case studies on health and environmental hygiene.

Semester IV

BIT-HC-4016 Molecular Biology

After studying this paper students will clearly understand

1. DNA structure and replication
2. DNA damage, repair and homologous recombination
3. Transcription and RNA processing
4. Regulation of gene expression and translation
5. Experiments on Preparation of solutions for Molecular Biology experiments; Isolation of DNA from different sources and their study.

BIT-HC-4026 Immunology

This paper will clearly explain about

1. Immune Response
2. Regulation of immunoglobulin gene expression
3. Major Histocompatibility complexes and other components of immunity.
4. Immunity to infection; vaccines.
5. Experimental exposure to blood cell counts, haemagglutination and haemagglutination inhibition assay; study on blood serum, microbial antigen and ELISA.

BIT-HC-4036 Chemistry-II

In this paper students will have a clear understanding on

1. s- and p- block elements, transition elements, coordination chemistry, state of matter and chemical kinetics.
2. Practical experiments for better understanding of the theory part

BIT-SE-4014 Industrial Fermentations

In Industrial fermentation paper students will have a clear understanding on,

1. Production of industrial chemicals, biochemical and chemotherapeutic products.
2. Microbial products useful in different fields.
3. Upstream and downstream processing in Purification & characterization of products. Fermentation
4. Enzyme kinetics
5. Comparative analysis of design of a batch and continuous fermenter; growth kinetics; Solvent extraction & analysis of a metabolite from a bacterial culture; Enzyme assay.
6. Experimental exposure to isolation of industrially important microbes, enzyme production by submerged and solid state fermentation, microbial growth kinetics, alcohol production, untrasonication, extraction of metabolites by soxhlet extraction.

BIT-HG-4016 Entrepreneurship Development

In this paper student will get to know about,

1. Basics of Entrepreneurship
2. Forms of Business Organization, Project Identification, Selection of the product, Project formulation, Assessment of project feasibility
3. Financing the enterprise
4. Marketing management
5. Entrepreneurship and international business

Semester V

BIT-HC-5016 Bioprocess Technology

In this paper students will have a clear understanding on

1. Introduction to bioprocess technology.
2. Design of bioprocess vessels and preparation of inocula.
3. Different factors affecting the bioprocess technology
4. Introduction to downstream processing, product recovery and purification. Effluent treatment.
5. Microbial production of ethanol, amylase, lactic acid and Single Cell Proteins.
6. Practical experiments on bacterial growth, thermal death point, production and analysis of different valuable products from microbes and isolation of industrially important microorganism.

BIT-HC-5026 Recombinant DNA Technology

In this paper, students will get a clear understanding on,

1. Molecular tools and applications;
2. Restriction and modification system; hybridization techniques, Genomic and cDNA library; DNA fingerprinting; Applications of Genetic Engineering in animals.
3. Mutagenesis, protein engineering
4. Genetic engineering in plants
5. Experimental exposure on isolation of chromosomal DNA from plant and bacteria; plamid isolation; Qualitative and quantitative analysis of DNA; Restriction digestion of DNA, Making competent cells; PCR

BIT-HE-5016 Bioinformatics

In this paper students will have a clear understanding on

1. Basic computer applications; History of Bioinformatics; Sequence Information Sources.
2. Protein Information Sources; Introduction of Data Generating Techniques and Bioinformatics problem posed by them- Restriction Digestion, Chromatograms, Blots, PCR.
3. Sequence and Phylogeny analysis
4. Searching Databases; Genome Annotation.
5. Practical exposure on sequence information resource; various web resources; BLAST; Retrieval of information from nucleotide databases; Sequence alignment; Multiple sequence .

BIT-HE-5026 Ecology & Environmental Management

In this paper students will have a clear understanding on

1. Scope of ecology; Principles and concepts of ecosystem.
2. Energy transfer in an Ecosystem.
3. Pollution and environmental Health; different communities
4. Environmental Biotechnology.
5. Experimental exposure on different components of ecosystem; study of population density; GPS; life table and fecundity table, study of soil and endangered/ threatened species.

Semester VI

BIT-HC-6016 Bio-Analytical Tools

In this paper students will be acquainted with,

1. Microscopy, photomicrography, spectroscopy
2. Spectroscopy, Centrifugation
3. Different chromatographic techniques
4. Electrophoresis, isoelectric focusing, Western blotting.
5. Molecular Techniques like PCR, RT-PCR, Gradient PCR, Real Time PCR, DNA Sequencer, DNA Synthesizer; Introduction to Biosensors and Nanotechnology

6. Experimental exposure to native gel electrophoresis SDS-PAGE, sub-cellular fractions of rat liver cells; preparation of protoplasts from leaves; paper chromatography; TLC; to verify the validity of Beer's law and determine the molar extinction coefficient of NADH; Gradient PCR.

BIT-HC-6026 Genomics & Proteomics

In this paper students will get acquaintance on

1. Genomics; DNA sequencing methods
2. Managing and Distributing Genome Data
3. Characterization of protein
4. Proteomics
5. Practical experiments on SNP databases at NCBI and other sites; OMIM database; Open Reading Frames ; Proteomics 2D PAGE database ; Softwares for Protein localization; Hydropathy plots; SDS-PAGE.

BIT-HE-6016 Biostatistics

In this paper students will have a clear knowledge on

1. Types, collection and representation of Data; Measures of central tendency and Dispersion. Measures of Skewness and Kurtosis.

2.Probability classical & axiomatic definition of probability, Theorems on total and compound probability), Elementary ideas of Binomial, Poisson and Normal distributions.

3. Methods of sampling, confidence level, critical region, testing of hypothesis and standard error, large sample test and small sample test. Problems on test of significance, t-test, chi-square test for goodness of fit and analysis of variance (ANOVA)
4. Correlation and Regression.
6. Practical experiments based on graphical Representation; measures of Central Tendency & Dispersion; Distributions Binomial Poisson Normal; Based on t, f, z and Chi-square

BIT-HE-6026 Dissertation/ Project

Students will get to perform a research work on a given topic and has to submit the findings as a dissertation and has to present his or her work.