

## B.Sc. Biotechnology (BSCBT)

### SEMESTER I

#### **BSCBT-101: Introductory Biotechnology**

##### **Unit I**

##### **Introduction: What is Biotechnology?**

What is agriculture?

What is biology?

What is biotechnology?

History of biotechnology?

What do you do with it?

Why do it?

Who does it?

Science method to solve a problem.

The role of biotechnology in our society.

The role of genetic variation and natural selection in evolution.

Applications of biotechnology

Careers in biotechnology.

##### **Unit II**

##### **Biochemistry and the Cell**

Atoms, Elements, Compounds

Chemical bonds

Life's key elements

Relate 5 key elements to the essential compounds of all living organisms.

Chemical reactions

Organic compounds

Proteins, Carbohydrates, Lipids, Nucleic Acids

Compare and contrast the role of Proteins, Carbohydrates, Lipids, and Nucleic Acids in life.

Enzymes

Explain the role of enzymes in living organisms.

Carbon - Oxygen cycle

Cells & Basic structure

Identify and locate cell structures and relate them to their functions.

Using energy

Discover the importance of glucose to living organisms.

Fermentation

Using a microscope to compare different types of cells.

##### **Unit III**

##### **Molecular Biology**

Nucleotides

Key elements and molecules

The structure of DNA.

Base pairing

The way in which genetic material is copied.

DNA and RNA

Describe the structure and function of RNA as it relates to protein synthesis.

Explain how proteins are made.

Replication, Transcription, Translation and Protein Synthesis

TLW--Extract DNA from known substances.

Restriction enzymes

The value of gel electrophoresis in learning the genetic code.

**Amplification & Cloning**

**Unit IV**

**Genetics**

Genes and Inheritance

Genes and DNA

Relate genes and heredity to DNA.

Discover patterns of inheritance in living organisms.

Homozygous and Heterozygous

Dominance and Recessiveness

Punnet squares

F1, F2, F...

Using a Punnet Square to determine patterns of inheritance in monohybrid (1-factor) and dihybrid (2- factor) crosses.

Problem solving

Using a computer model to solve genetic/heredity problems.

Isolate and fingerprint DNA to discover the infinite potential of the genetic code.

Karyotype chromosomes to discover how sex and certain diseases are inherited.

Disease and disorders

Genetic counseling

**Unit V**

**Microbiology**

Bacteria and viruses as pathogens

The characteristics of bacteria.

The characteristics of viruses.

Harmful versus helpful bacteria and viruses

Antigen and Antibody

Understanding how the immune system combats pathogens.

Cultures, Sterile techniques

Using sterile techniques to culture bacteria.

Transformation, Plasmids and Conjugation

Engineering with microbes

Why bacteria and viruses are essential tools of biotechnology.

Immune system

How the immune response is used in the development of consumer products, industry, and medicine.

**Unit VI**

**Applications of Biotechnology**

**Plants**

Plant systems

The anatomical and physical development of plants.

Photosynthesis / Respiration

Sexual vs. Asexual Reproduction

Describe the principles of sexual and asexual reproduction in plants.

Propagate plant tissue using tissue culture techniques.

**Animals**

Animal systems

The anatomical and physical development of animals.

## Digestion / Rumination

the digestion process in a ruminant animal.

The principles of reproductions in animals.

## Reproduction Technologies

- \* Artificial Insemination
- \* Embryo Transfer
- \* Embryo Sexing
- \* Cloning Embryos

The process of embryo sexing, splitting, and cloning.

## Recombinant DNA

- \* BST
  - \* Genetic Engineering in Animals
- appropriate techniques in setting up animal tissue cultures.

## Food Science

Food composition

Food safety

Food preservation

How biotechnology is used to insure the safety of food and food processing.

The role of biotechnology in consumer foods.

Fermentation

- \* industrial
- \* traditional

## Medical

Antibody

Antigen

Using the interactions between antigen and antibody to determine hormone levels.

Vaccines

How vaccines provide immunity to diseases.

Infectious diseases

Viruses

Blood typing

Describe the production, use, and abuse of antibiotics.

Describe the current research being done on HIV and cancer.

## The Human Genome Project

The Human Genome

Goals of the Human Genome Project

Genetic Linkage Maps

Polymorphic DNA Markers

Physical Maps

Sequence - Tagged Sites

Integrating Genetic Linkage

DNA Sequencing

Ethical, Legal and Social Implications

## Unit VIII

### Ethical Issues and the Future

The positives, negatives, and importance of biotechnology.

What are the issues?

Is there a right and wrong?

Crime / forensics & DNA?

Super humans and eugenics  
Is Jurassic Park possible?  
Environmental impact / "over-engineering"  
Saving endangered species  
Current issue in biotechnology.  
The ethics of genetic engineering and biotechnology.

## **BSCBT-102: General Microbiology**

### **Unit I**

Microscope (optical, TEM and SEM)  
Experiments of Pasteur's.  
Sterilization : Methods (Dry heat, wet heat, radiation and chemical etc.).

### **Unit II**

Various forms of Microorganism (PPOs, Cocci, bacilli and spirilla)  
Concept of stains.  
Microbial cell wall. Gram positive and gram negative bacteria.

### **Unit III**

Prokaryotic and Eukaryotic microbial cells.  
Gene transfer in micro-organism.  
Nutritional classification of micro-organism.

### **Unit IV**

Classification and their role in bioprocesses of Biomolecules.  
Molecules involved in generation of mechanical stability - papetidoglycans, polysaccharides.  
- Membrane lipids.

### **Unit V**

Molecular involved in information storage and retrieval - nucleic acid.  
Molecules executing mediator and catalytic functions - the protein.

### **PRACTICAL**

Sugar in given sample.  
Extraction and separation of lipids.  
Estimation of Protein.  
Cleaning of glassware and sterilization.  
Preparation of media.  
Microbes from hands, tooth - scum and other body parts.  
Identification of isolation bacteria (Gram Staining or other staining methods).

## **BSCBT-103: Biochemistry**

### **Unit I**

(i) Introduction to Biochemistry and role of medical microbiologist.  
(ii) Ethics.  
(iii) Safety measure and hazards in clinical biochemistry lab and first aid.

### **Unit II**

(i) Basic aspects of Bioenergetics.  
(ii) Entropy, enthalpy and concept of free energy.  
(iii) Thermodynamic law first and second.

### **Unit III**

(i) Carbohydrate : Structure, properties, chemical reactions and functions.  
(ii) Amino acid : Essential and nonessential amino acids with structure and function.  
(iii) Proteins : Primary, Secondary Tertiary and Quaternary (overview)

#### **Unit IV**

- (i) Lipids : classification and properties.
- (ii) Enzyme : Classification, mechanism of enzyme action, catalyzed reaction.
- (iii) Enzyme inhibition.

#### **Unit V**

- (i) Nucleic Acid : Structure of purine and pyrimidine bases, Nucleotide and Nucleosides.
- (ii) DNA and RNA structure and properties.
- (iii) Vitamins (Fat and water soluble).

#### **Practical**

- (i) Blood glucose and its determination by different methods.
- (ii) Glucose tolerance test. (GTT)
- (iii) Estimation of blood urea.
- (iv) Estimation of blood creatinine.
- (v) Estimation of blood cholesterol.
- (vi) Estimation of serum calcium and phosphorus.
- (vii) Estimation of plasma protein.
- (viii) Determination of Protein in Urine.

### **BSCBT-104: Introductory Biology**

#### **Unit I**

##### **Living World**

Biology & Its Branches; relationships with other sciences; scientific methods in Biology; historical breakthroughs; scope of biology and career options; role of Biology in dispelling myths and misbeliefs; characters of living organisms, (elementary idea of metabolism, transfer of energy at molecular level, open and closed systems, homeostasis, growth and reproduction, adaptation, survival, death).

Origin and evolution of life - theories of evolution; evidence of evolution; sources of variations

( mutation, recombination, genetic drift, migration, natural selection); concept of species; speciation and isolation (geographical and reproductive); origin of species.

#### **Unit II**

##### **Diversity of Life**

Variety of living organisms, Systematics; need, history and types of classification (artificial, natural, polygenetic); biosystematics; binomial nomenclature; Two kingdom system, Five kingdom System, their merits and demerits, status of bacteria and virus; botanical gardens and herbaria; zoological parks and museums.

#### **Unit III**

##### **Cell and Cell Division**

Cell as a basic unit of life - discovery of cell, cell theory, cell as a self - contained unit; prokaryotic and eukaryotic cell; unicellular and multicellular organisms; tools and techniques ( compound microscope, electron microscope and cell fractionation); Ultrastructure of prokaryotic and eukaryotic cell - cell wall, cell membrane - fluid mosaic model; membrane transport; cellular movement (exocytosis, endocytosis); cell organelles and their functions

- nucleus, mitochondria, plastids, endoplasmic reticulum, Golgi complex, lysosomes, lysosomes, microtubules, centriole, vacuole, cytoskeleton, cilia and flagella, ribosomes.

Molecules of cell; inorganic and organic materials - water, salt, mineral ions, carbohydrates, lipids, amino acids, proteins, nucleotides, nucleic acids (DNA and RNA);

Enzymes (Properties, chemical nature and mechanism of action); vitamins, hormones and steroids.

#### **Unit IV**

##### **Genetics**

Continuity of life - heredity, variation; Mendel's laws of inheritance, chromosomal basis of inheritance; other patterns of inheritance - incomplete dominance, multiple allelism, quantitative inheritance.

Chromosomes - bacterial cell and eukaryotic cell; parallelism between genes and chromosomes; genome, linkage and crossing over; gene mapping; recombination; sex chromosomes; sex determination; sex linked inheritance; mutation and chromosomal aberrations; Human genetics - methods of study, genetic disorders.

DNA as a genetic material - its structure and replication; structure of RNA and its role in protein synthesis; Gene expression - transcription and translation in prokaryotes and eukaryotes; regulation of gene expression, induction and repression - housekeeping genes; nuclear basis of differentiation and development; oncogenes.

Basics of Recombinant DNA technology; cloning; gene bank; DNA fingerprinting; genomics - principles and applications, transgenic plants, animals and microbes.

#### **Unit V**

##### **Morphology of Plants and Animals**

Morphology - root, stem and leaf, their structure and modification; Inflorescence, flower, fruit, seed and their types; Description of Poaceae, Liliaceae, Fabaceae, Solanaceae, Brassicaceae and Asteraceae.

Morphology of animals - salient features of earthworm, cockroach and rat; tissue systems, structure and function of tissues - epithelial, connective, muscular and nervous.

##### **Practical**

1. Study of parts of Compound Microscope
2. Study of mitosis in onion root tip and animal cell (grasshopper)
3. Study of meiosis in onion flower buds, and testis of grasshopper.
4. Study of cyclosis in leaf cell of Hydrilla, or Tradescantia and in Paramecium.
5. Study of cell wall components ( cellulose, lignin, suberin and mucilage).
6. Study of mitochondria by staining with a Janus Green.
7. Study of specimens and their identification with reason - Bacteria, Oscillator, Spirogyra, Rhizopus, mushroom/bracket fungi, yeast, liverwort, moss, fern, Pinus, one monocotyledon, one dicotyledon and lichens.
8. Study of characters of specimens and identification with reason - Amoeba, Hydra, Liver - Fluke, Ascaris, Leech, Earthworm, Prawn, Silk moth honey bee, snail, Starfish, Dogfish, Rohu, Frog, Lizards, Pigeon/ any other bird and rabbit/ any other mammal.
9. Study of squamous epithelium, muscle fibres, nerve cells and mammalian blood film through temporary/permanent slides.
10. Study of external morphology of earthworm, cockroach, frog and rat through models.

#### **BSCBT-105: Communication & Soft Skills**

##### **UNIT I**

##### **Essentials of Grammar:**

- Parts of Speech
- Punctuation
- Vocabulary Building
- Phonetics

## **UNIT II**

### **Office Management:**

- Types of Correspondence
- Receipt and Dispatch of Mail
- Filing Systems
- Classification of Mail.
- Role & Function of Correspondence
- MIS
- Managing Computer

## **UNIT III**

### **Letter & Resume Writing:**

- Types of Letters-Formal / Informal
- Importance and Function
- Drafting the Applications
- Elements of Structure
- Preparing the Resume
- Do's & Don'ts of Resume
- Helpful Hints

## **UNIT IV**

### **Presentation Skills:**

- Importance of Presentation Skills
- Capturing Data
- Voice & Picture Integration
- Guidelines to make Presentation Interesting
- Body Language
- Voice Modulation
- Audience Awareness
- Presentation Plan
- Visual Aids
- Forms of Layout
- Styles of Presentation.

## **UNIT V**

### **Interview Preparation:**

- Types of Interview
- Preparing for the Interviews
- Attending the Interview
- Interview Process
- Employers Expectations
- General Etiquette
- Dressing Sense

- Postures & Gestures

## **UNIT VI**

### **Group Discussion & Presentation:**

- Definition
- Process
- Guidelines
- Helpful Expressions
- Evaluation

(Note: Every student shall be given 15 minutes. of presentation time & 45 minutes of discussion on his/ her presentation.)

**The student will be evaluated on the basis of :**

his / her presentation style

Feedback of Faculty & Students

General Etiquette

Proficiency in Letter Drafting / Interview Preparation

The paper is internal and at least 3 tests will be taken. Best 2 of 3 shall account for final grades (70% Test & 30% Presentation)

### **SEMESTER I**

#### **BSCBT-106: Practical**

Introductory Biotechnology - 10 Marks

General Microbiology - 15 Marks

Biochemistry - 25 Marks

Introductory Biology - 25 Marks

Internal Assessment: 25 Marks

### **SEMESTER II**

#### **BSCBT-201: Genetic Taxonomy & Genome**

##### **Unit I**

Nature of gene : chemical nature.

Gene cistron relationship in Prokaryotes and eukaryotes.

Gene families and pseudogenes.

##### **Unit II**

Overlapping gene.

Transgenes.

Transposable elements.

##### **Unit III**

Gene Mutation.

Physical and Chemical Mutagens.

Molecular Mechanism.

##### **Unit IV**

Gene organisation (Principle)

Separation Techniques : Northern and Southern.

##### **Unit V**

Gene libraries

Ligation and selection technique.

Selection by genetic recombination.

## SEMESTER II

### BSCBT-202: Enzymology

#### Unit I

Enzyme : Introduction, classification, Protein and non protein enzymes.

Catalytic reaction of enzyme.

Kinetics of enzyme.

#### Unit II

In vitro activity of purified enzymes and their applications in industry.

Enzyme uses in food processing, medicine, diagnostics and production of new compounds.

Enzymes as research tool - modification of biological compounds with the help of enzyme.

#### Practical

Assays of Enzyme diagnostic.

Kinetic studies on enzymes.

## SEMESTER II

### BSCBT-203: Immunology

#### Unit I

Immune system :

Immunity

Organs of the immune system with function.

#### Unit II

Antigen - Antibody and their structure.

Antigen antibody interaction.

#### Unit III

Humoral immunity.

Cell mediated immunity (role of MHC and genetic restriction).

#### Practical

Purification of antigens.

Purification of antibodies.

Conjugation and labeling of antibodies.

ELISA

RIA

## SEMESTER II

### BSCBT-204: Genetic Engineering

#### Unit I

Concept of gene.

Structure of gene.

Significance of gene.

#### Unit II

Introduction of Genetic Engineering.

Tools of Genetic Engineering : Vectors and Enzyme.

Laboratory requirement and Safety of Genetic Engineering techniques.

#### Unit III

Introduction of Gene cloning.

Purification and digestion of DNA.

Insertion of DNA into vectors.

#### Unit IV

Insertion of recombinant DNA into host.  
Identification of hybrid clone.

**Unit V**

Genetic Engineering in Plants : Molecular breeding.  
Genetic Engineering in Medicine : Gene Therapy.  
Genetic Engineering in Forensic Science : DNA finger Printing.

**SEMESTER II**

**BSCBT-205: Practical**

Genetic Taxonomy & Genes : 20 Marks  
Enzymology : 20 Marks  
Immunology : 15 Marks  
Genetic Engineering : 20 Marks  
Internal Assessment: 25 Marks

**SEMESTER III**

**BSCBT-301: Fermentation Techniques**

**Unit I**

Introduction : Fermentation, Fermentor.  
Design of Fermentor.

**Unit II**

Local condition with in a fermentor.  
Ideal Fermentor.

**Unit III**

Types of Fermentors (Principle and Parts)  
Batch fermentor (BF)  
Continuous stirred-tank Fermentor (CSTF)

**Unit IV**

Tubular Fermentor (TF) (Principle and parts)  
Fluidiced bed Fermentor (FBF)

**Unit V**

Computer control of fermentation processes :  
Introduction.  
Instrument.  
Computer application in Fermentation Technology.

**SEMESTER III**

**BSCBT-302: Cell Biology**

**Unit I**

Cell structure : Prokaryotic and Eukaryotic.  
Structure of Plasma membrane with different models.  
Structure of cell organelles (overview)

## **Unit II**

Structure of chromosome.  
Structure of DNA and types.  
Different types of RNA.

## **Unit III**

Cell Division : Mitosis.  
Meiosis : The reduction division.  
Significance of DNA.

## **Practical**

Cell counting method - haemocytometer.  
Cytological preparations - Fixation, dehydration  
Staining.  
Squash in stain.  
Embedding and sectioning.  
Separation of cell types (from blood)  
Separation of cell organelles.

## **BSCBT-303: Tissue Culture**

### **Unit I**

Introduction of Tissue culture.  
History of development.  
Primary and secondary culture.

### **Unit II**

Anchorage and non Anchorage depends of growth.  
Growth kinetics and organ culture.  
Application of Tissue culture for gene expression.

## **SEMESTER III**

### **BSCBT-304: Molecular Biology**

**Unit I:- Cell:-** Cell organelles: Structure function, structure of mitochondria and organization of respiratory chain, organization of cytoskeleton and nucleic.

### **Unit -II:- STRUCTURE & PROPERTIES OF DNA**

Discovery of DNA as the genetic material, Structure of DNA (A,B&Z forms ), concept & definition of the genome, C-value paradox, denaturation & renaturation of DNA, repetitive & non-repetitive DNA, reassociation kinetics. Cot curve, Rot curve, chemical & kinetic complexity of DNA, supercoiling in DNA.

**Unit -III :- PROKARYOTIC AND EUKARYOTIC GENOME ORGANIZATION:-**Organization of viral genome,

organization of bacterial genome, chromosome structure in eukaryotes, nucleosome model, chromatin

structure, satellite DNA, polytene chromosomes, lampbrush chromosomes, B chromosomes- Evolution

of the gene concept, definition of gene, interrupted genes, multigene families & pseudogenes,

overlapping genes, nested genes, open reading frames.

**Unit-IV:-DNA REPLICATION:-** General features of DNA replication in prokaryotes & eukaryotes,

enzymology of DNA replication, regulation of DNA replication

**Unit-V:- GENE MUTATION, REPAIR & RECOMBINATION:-**Definition & types of mutation, mutagenic

agents & their mode of action, reversion & suppression of mutation.

DNA repair mechanisms : light dependent repair, excision repair, mis-match repair Post-replication

repair, sos response.

DNA recombination mechanisms : holiiday model, Rec A, Rec BCD, gene conversion

### **SEMESTER III**

#### **BSCBT-305: Practical**

Fermentation Techniques : 20 Marks

Cell Biology : 25 Marks

Tissue Culture : 20 Marks

Molecular Biology : 15 Marks

Internal Assessment : 25 Marks

### **SEMESTER IV**

#### **BSCBT-401: Bio-chemical Techniques**

##### **Unit I**

Nature of Biological material.

General properties of organic compounds.

Hydrophilic and Hydrophobic groups in biological molecules.

##### **Unit II**

Perspectives of biological macromolecules : the repeating units in nucleic acids and proteins.

Helicity, bending, looping, pleats, salt bridges and their determents.

The basis for intermolecules interaction eg : enzyme substract and antigen antibody recognition.

##### **Unit III**

Energetics of a living body.

Principle of Colorimetry and spectrophotometer.

Strategies of light reception in microbes :- Plant and animals.

##### **Unit IV**

Intra and intermolecular interactions in biological systems.

Spatial and charge compatibility as determination of such interaction.

##### **Unit V**

General spectroscopy of

UV-Vis

Fluorescence

Atomic absorption

## **SEMESTER IV**

### **BSCBT-402: Bio-physical Techniques**

#### **Unit I**

Principle & application of Light Microscope

Phase Contrast Microscope

Fluorescence Microscope

SEM & TEM

#### **Unit II**

Principles & applications of paper chromatography

Thin layer chromatography

Affinity & Ion Exchange Chromatography

HPLC

Fixation Staining

#### **Unit III**

Principles of biophysical methods used for analysis of biopolymer structure.

X-ray diffraction, NMR & ESR spectroscopy

#### **Unit IV**

Principles and Applications of traces techniques in Biology

Radiation dosimetry

Radioactive isotopes & half life on isotopes

Scintillation spectrophotometry

### **BSCBT-403: Industrial Biotechnology**

#### **Unit I**

Application of Biotechnology in Agriculture.

Biofertilizer and Nitrogen fixers.

Bio-pesticides.

Bio-weedicis Biotechnology.

#### **Unit II**

Application of Biotechnology in Medicine

Vaccine

Steroids transformation.

Protein formation.

#### **Unit III**

Application of Biotechnology in Paper industry and plant petroleum.

#### **Unit IV**

Application of Biotechnology in Environment.

Biotechnological inputs in producing good quality natural fibres.

Conventional fuel and their environmental impacts.

Plant and animal wastes.

Animal oil

#### **Unit V**

Application of Biotechnology in Food Industry.

Beverages.

Bakery

Dairy Product.

## **INDUSTRIAL APPLICATION PRACTICAL**

Study of Products which are manufactured in industry, on the basis of biotechnology principle.

### **SEMESTER IV**

#### **BSCBT-404: Instrumentation**

##### **Unit-1 :-**

Centrifugation : principle, types, analytical and preparatory centrifugation, differential density

gradient centrifugation, sedimentation and coefficient centrifuge and its application.

Electrophoresis : principles, types and application (paper, starch, polyacrylamide and agarose electrophoresis).

Chromatography : principle, types and application of paper, thin layer, ion exchange, gas chromatography and HPLC.

##### **Unit - 2 :-**

Microscopy : light, phase contrast, interference & electron microscopy

Radioactivity : saddy-fajans & russel group displacement law, half life period, disintegration or decay constant, transmutation or disintegration of elements. Radio carbon dating method, application of transmutation reaction (artificial radioactivity). Geiger muller counter, scintillation, liquid, crystal & gamma counter.

##### **Unit -3 :-**

Basic principles of spectroscopy ; electromagnetic radiations, wave properties & parameters, electromagnetic spectrum spectroscopic methods in each region, types of spectra & interaction mechanisms.

UV-vis spectroscopy, TR spectroscopy, nuclear magnetic resonance spectroscopy (NMR), electron spin resonance spectroscopy (ESR).

##### **Unit - 4 :-**

Atomic spectroscopy - principle, instrumentation, preparation of samples, applications.

Flame photometry.

X-ray crystallography - principle, instrumentation and applications. ORD & CD ; fundamental principle, cotton effect, birefringes, refractive indices. Application of ORD & CD for quantitative

analysis, octant rule, haioketone rule. Principle, instrumentation & application of polarimetry,

### **SEMESTER IV**

#### **BSCBT-405: Practical**

Bio-Chemical Techniques : 20 Marks

Bio-Physical Techniques : 15 Marks

Industrial Biotechnology : 20 Marks

Instrumentation : 20 Marks

Internal Assessment : 25 Marks

## SEMESTER V

### BSCBT-501: Animal Biotechnology

#### Unit I

General metabolism.

Secondary metabolites/Products (insulin, Growth hormone, Interferon, factor VIII etc.)

Expressing cloned proteins in animal cells, production and processing of chosen protein.

#### Unit II

Introduction to invitromethod : Terms and definition, growth regulators.

Embryo culture, embryo rescue after wide hybridization, and its application.

Introduction to the process of embryogenesis and organogenesis and their practical application.

#### Unit III

Haploids and their application.

Somaclonal variation and application.

Clonal multiplication of elite species.

#### Practical

Practical application of genetic transformation (theory).

## SEMESTER V

### BSCBT-502: Plant Biotechnology

#### Unit I

Introduction to protoplast isolation : Principle and application.

Testing of viability of isolated protoplast.

Various steps in the regeneration of protoplast.

#### Unit II

Introduction to somatic hybridization.

Various method for fusing protoplast.

Use of markers for selection of hybrid cells.

#### Practical

Practical application of somatic hybridization (theory).

### BSCBT-503: Environmental Biotechnology

#### Unit I

Renewable and non renewable resources.

Renewable should be bio-assimilable/bio degradable.

Major consumer items : Food, fuel and fibres.

#### Unit II

Conventional fuel and their environmental impacts.

Firewood

Plant and animal wastes.

Coal

Gas

Animal oil

#### Unit III

Modern fuels and their environmental impacts.

Methogenic bacteria and biogas.

Microbial hydrogen production.  
Conversion of sugars to ethanol.  
Cellulose degradation for combustible fuel.  
Plant based petroleum industry.

#### **Unit IV**

Biotechnological inputs in producing good quality natural fibres.  
Microbiological quality of food and water.

#### **Unit V**

Biofertilizers.  
Treatment of municipal waste and industrial effluents.  
Degradation of pesticides and other toxic chemicals by micro-organism.

#### **Practical**

Practical application of tissue and organ culture (summarizing the practical application of all the above mentioned techniques in paper) only theory.

### **SEMESTER V**

#### **BSCBT-504: Pharmaceutical Biotechnology**

##### **Unit I**

Production recombinant pharmaceuticals :  
Recombinant insulin  
Human Growth factor synthesis  
Recombinant factor VIII

##### **Unit II**

Synthesis of :  
Recombinant vaccine  
Recombine Protein  
Live recombinant vaccine

##### **Unit III**

Identification of genes responsible for human disease.  
Breast cancer  
Autosomal dominant and recessive disorders.  
X-linked disorders.

##### **Unit IV**

Gene therapy of somatic cell.  
Genetic Manipulation of Grem cell.

##### **Unit V**

Prospects and  
Ethics of gene therapy

### **SEMESTER V**

#### **BSCBT-505: Practical**

Animal Biotechnology : 20 Marks  
Plant Biotechnology : 20 Marks  
Environmental Biotechnology : 10 Marks  
Pharmaceutical Biotechnology : 25 Marks  
Internal Assessment : 25 Marks

## SEMESTER VI

### **BSCBT-601: Bio-informatics**

Introduction to Bioinformatics.

Uses of Bioinformatics.

Applications of Bioinformatics

Websites for Bioinformatics.

Fact file of Bioinformatics.

### **SEMESTER VI**

#### **BSCBT-602: Drug Design**

Pharmacology.

Drug metabolism.

Pharmacogenetics.

Frontiers in pharmacology.

#### **Unit V**

Statistical methods in Pharmacology.

Introduction to Research in pharmacology.

Introduction to Pharmacoinformatics.

### **SEMESTER VI**

#### **BSCBT-603: Research Methodology**

Introduction to Research: Definition, Scope, Limitations, and Types.

Objectives of Research

Research Process

Research Designs

Data Collection: Secondary Data, Primary Data, and Methods of Collection.

Scaling Techniques: Concept, Types, Rating scales & Ranking Scales

Scale Construction Techniques, Multi Dimensional Scaling.

Sampling Designs: Concepts, Types and Techniques

Sample Size Decision

Theory of Estimation and Testing of Hypothesis

Small & Large Sample Tests, Tests of Significance based on t, F, Z test and Chi-Square Test.

Designing Questionnaire.

Interviewing.

Tabulation, Coding, Editing.

Interpretation and Report Writing.

### **SEMESTER VI**

#### **BSCBT-604: Information Technology & Bioinformatics**

##### **Unit I**

Overview of computers.

Operating system and networking concept (Windows, UNIX, Linux)

Basics of internet and websites.

##### **Unit II**

MS-Office.

Data structure and Algorithms.

Bioinformatics Internet Applications

**SEMESTER VI**

**BSCBT-605: Practical**

Bio-informatics :20 Marks

Drug Design :15 Marks

Research Methodology :20 Marks

Information Technology & Bioinformatics :20 Marks

Internal Assessment: 25 Marks