Detailed Syllabus
of

B.Sc. (Bio-Technology)

Duration : 06 Semesterss

Total Degree Marks : 1700

SEMESTER-I

Course Name	Course Code	Marks		
		Theory	Practical	Total
Biotechnology	BBT-S110	100	00	100
Mathematics	BBT –S120	100	00	100
Computers	BBT –S130	100	00	100
Statistics	BBT –S140	100	00	100

SEMESTER-II

Course Name	Course Code	Marks		
		Theory	Practical	Total
Cell Biology	BBT-S210	100	00	100
Genetics	BBT –S220	100	00	100
Microbiology	BBT –S230	100	00	100

SEMESTER- IIII

Course Name	Course Code	Marks		
		Theory	Practical	Total
BioPhysics	BBT-S310	100	00	100
Molecular Biology	BBT-S320	100	00	100

SEMESTER-IV

Course Name	Course Code	Marks		
		Theory	Practical	Total
Methods in molecular and Cell Biology	BBT-S410	100	00	100
Immunology	BBT –S420	100	00	100
Animal Cell Culture	BBT –S430	100	00	100

SEMESTER-V

Course Name	Course Code	Marks		
		Theory	Practical	Total
Recombinant DNA Technology	BBT-S510	100	00	100
Immunology Methods	BBT –S520	100	00	100

SEMESTER VI

Course Name	Course Code	Marks		
		Theory	Practical	Total
Animal cell Biotechnology	BBT-S610	100	00	100
Plant Biotechnology	BBT –S620	100	00	100
Environmental Biotechnology	BBT –S630	100	00	100

SEMESTER-I

Bio-technology	Course Code :BBT-S110

1. Nature of biological material. Introduction to Biochemistry, cell and its components. Brief mention of various micro and macro bimolecules.
2. General properties of organic and inorganic compounds
3. Classification of biomolecules based on their role in bioprocesses.
4. Molecules involved in generation of mechanical stability.
5. Molecule involved in information storage and retrieval -t he nucleic acids.
6. Molecules executing mediator and catalytic functions - the proteins.
7. The Signal molecules.
8. Enzymes, Introduction, classification, Enzyme assay, Inhibition and Regulation enzymes, Role in biosynthetic and degradative enzymes. Protein and non-protein enzymes, Enzyme Kinetics, Application of enzymes, Biotransformation.
9. Energy transactions in living systems.

Mathematics	Course Code:BBT-S120

- The Set Theory and Properties of Sub Sets.
- Limits of Functions
- Derivatives of Functions
- Binomial Theorem
- Logarithms
- Differentiation
- Integration

Computers	Course Code :BBT-S130

- General Introduction to Computers
- Generations of Computers
- Stores Program Concept
- Functional Block of Computers
- Organization of Computer
- Classification of Computers
- Ana, Digi, Hybrid Computers.
- Classification of Digital Computers
- General purpose and dedicated Computers
- Real Time Systems
- Characteristics of Computers
- Hardware / Software and Firmware.
- Algorithms, Pseudocodes
- Flowcharts
- Computer in online monitoring and automation

Statistics	Course Code :BBT-S140

- Probability
- Methods of Sampling, confidence level
- Measurement of central tendencies
- Measurements of deviations.

SEMESTER II

Cell Biology	Course Code:BBT-S210

- Cell as a basic unit of living system. Cell Theory.
- Precellular evolution: Artificial creation of cells.
- Broad Classification of Cell types
- Biochemical composition of cells
- Structure and function of cell organelles.
- Cell Division and Cell Cycle (incl. Cell Synchrony and its applications)
- Cell - Cell integration.
- Cell Locomotion (amoeboid, flagellar and ciliar)
- Muscle and nerve cells.
- Cell Differentiation in plants and animals.

Genetics	Course Code:BBT-S220

- Nature of Genetic material. DNA replication.
- Mendelian laws of inheritance.
- Sex determination in plants and animals.
- Linkage, Cross over, chromosomal maps, inheritance, coincidence
- Chromosomes
- Structural and numerical abbreviation involving Chromosomes
- Mutations
- Basic microbial genetics
- Extra chromosomal inheritance, mitochondrial and chloroplast genetic systems.

Microbiology	Course Code:BBT-S230

- Development of Microscopy
- Contributions of other Eminent
- Concept of Sterilization.
- Microbial Taxonomy
- Nature of Microbial Cell Surface
- Prokaryotic and Eukaryotic Microbial Cells
- Nutritional Classification of Microorganisms
- Microbes in Extreme Environment
- Pathogenic Microorganisms
- Symbiosis and Antagonism among Microbial Populations
- N2 - Fixing Microbes in Agriculture - (Rhizobium)
- Microbial Metabolism (Respiration, Photosynthesis)
- Fermentation Products. (Alcohol, Vinegar, Enzymes, Vitamins Food)

Practicals – Biochemical Techniques

SEMESTER-III

Biophysics	Course Code: BBT-S310

- Energetics of a living body, sources of heat limits to temperature. Heat dissipation and conservation.
- Lambert-Beer law. Sectrophotometry and Colorimetry Primary events in Photosynthesis
- Strategies of light reception in Microbes Plants and Animals
- Correction of Vision faults.
- Electrical properties of biological compartments. Electricity as a potential signal.
  Generation and reception of sonic vibrations. Heating aides.
- Intra and intermolecular interactions in biological systems. Spatial
- and charge compatibility as determinant of such interactions.
  Physical methods applied to find out molecular structure.
  X-ray crystallography and NMR
- General spectroscopy - UV - vis, fluorescence, atomic absorption, IR,
- Raman Spectra.
- Physical methods of imaging intact biological structures

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Molecular Biology	Course Code:BBT-S320

- Molecular Basis of life
- Structure of DNA
- DNA replication both prokaryotes and eukaryotes
- DNA recombination molecular mechanisms prokaryotic and eukaryotic
- Insertion elements and transposes
- Structure of prokaryotic genes
- Prokaryotic translation
- Prokaryotic gene expression (lac, his, trp, catabolic repression)
- Structure of eukaryotic genes
- Eukaryotic translation.
- Eukaryotic gene expression transcription factors etc.
- Gene expression in Yeast.
- Gene expression in protozoan parasites.
- Gene Organization and expression in mitochondria Chloroplastics.
- Post translation regulation of gene expression
- Development and environmental regulation in Gene expression.

SEMESTER-IV

Methods in Molecular and Cellular Biology	Course Code : BBT-S410

1.Cytological Preparations
2.Cell counting Methods
3.Measurements with the help of light microscope
4.Separation of cell types (From blood)
5.Separation of cell organelles:
6.Extraction of cellular materials
7.Separation of the constituent molecule of the extract in aqueous buffers
8.Thin Layer chromatography of extracted materials.
9. Isolation of chromosomal and plasmid DNA from Bacteria.
10.Restriction Digestion of DNA and assigning restriction sites (may be done as a demonstration)
11.Making complete E.coli
12.Transfection of plasmid DNA and selection for transformants.

Immunology	Course Code:BBT-S420

1.The immune system and Immunity along with historical perspective.
2.Antigen - Antibody and their structure.
3.The organs and the cells of the immune system and their function.
4.Antigen - Antibody Interaction.
5.Humoral and cell mediated immunity (role of MHC and genetic restriction).
6.Origin of diversity in the immune system.
7.Effector Mechanism
8.Immunity to infectious diseases. Vaccines.

Animal Cell Culture	Course Code:BBT-S430

1. History of development of cell cultures.
2. The natural surroundings of animal cells
3. Metabolic capabilities of animal cells
4. Simulating natural condition of growing animal cells.
5. Importance of growth factors of the serum
6. Primary cultures. Anchorage dependence of growth. Non-anchorage dependent Cells.
7. Secondary Cultures. Transformed animal cells - Established/ Continuous cell lines.
8. Commonly used animal lines. - Their origin and characteristics.
9. Growth kinetic of cells in culture.
10. Applications of animal cell culture for studies on gene expression.
11. Organ Culture.
12. Transfection of animal cells: Selectable makers. HAT selection, antibiotic resistance etc.
13. Cell fusion; Transplantation of cultured cells.
14. Differentiation of Cells.

SEMESTER-V

Recombinant DNA Technology	Course Code:BBT-S510

1. What is gene cloning and why do we need to clone a gene.
2. Tools and Technology plasmids and other vehicles genomic DNA, RNA, DDNA, RT enzymes and other reagents techniques. Laboratory requirements.
3. Safety measures and regulations for recombinant DNA work.
4. Choice and selection of the tools and the techniques.
5. Vehicles: Plasmids and bacteriophages. Available phagemids, cosmids,viruses.
6. Purification of DNA from bacterial, plant and animal cells.
7. Manipulation of purified DNA.
8. Introduction of DNA into living cells.
9. Cloning vectors for E.coli.
10. Cloning vectors for organisms others than E.coli yeast. Fungi, plants-agrobact, plant virus animal viruses.
11. Application of cloning in gene analysis
12. Gene cloning and expression of foreign genes in research and biotechnology.
13. Production of Protein from Cloned Genes
14. Gene Cloning in Medicine.

Immunology Methods	Course Code:BBT-S520

1. Purification of antigens.
2. Raisine polyclonal antibodies conjugation and labeling of antibodies Enzyme - linked immunoassay.
3. Radio immunodiffusion analysis
4. Generation of ascetic fluid.
5. Diagnosis of an infectious disease by an immunoassay

ON THE JOB TRAINING

This should be taken up during summer over a period of one month preferably in an immunology/veterinary/virology institute or a laboratory using recombinant DNA methods.

SEMESTER VI

Animal Cell Biotechnology	Course Code:BBT-S610

1. General Metabolism
2. Special Secondary metabolites/products (insulin, Growth hormone, Interferon, t-plasminogen activator, factor VIII etc)
3. Expressing cloned proteins in animal cells. Over production and processing of chosen protein.
4. The need to express in animal cells.
5. Production of vaccines in animal cells.
6. Production of monoclonal antibodies
7. Growth factors promoting proliferating of animal cells (EGF, PDGF, IL-I, IL-2, NGF, erythroprotein etc)
8. Bioreactors for large-scale culture of cells
9. Transolanting cultured cells.

Plant Biotechnology	Course Code:BBT-S620

1. Introduction to the vitro methods. Terms and definitions use of growth regulators.
2. Beginning of into vitro cultures in our country (ovary and ovule culture, in vitro pollination and fertilization).
3. Embryo culture, embryo rescue after wide Hybridization and its applications.
4. Introduction to the processes of embryogenesis and organ genesis and their practical applications.
5. Clonal Multiplication of elite species.
6. (Micro propagation) Exillary bud, shoot-tip and meristem culture.
7. Haploids and their applications. Somaclonal variations and applications (Treasure your exceptions)
8. Endosperm culture and production of triploids.
9. Practical applications of tissue and organ culture (Summarizing the practical applications of all the above mentioned techniques).
10. Single - Cell suspension cultures and their applications in selection of variants/Mutants with or without mutagen treatment (of haploid cultures preferably)
11. Introduction of protoplast isolation: principles and applications.
12. Testing of viability of isolated protoplasts.
13. Various steps in the regeneration of protoplasts.
14. Somantic Hybridization - an introduction.
15. Various methods for fusing protoplasts. Chemical, Electrical.
16. Use of markers for selection of hybrid cells.
17. Practical applications of somatic hybridization (Hybrids Vs Gybrids)
18. Use of plants cell, protoplasts and tissue culture for genetic manipulation of plants, Introduction to A.tumefaciens.
19. Tumor formation on plants using A. Tumeracines (Monocots Vs Dicots)
20. Root - Formation using A. rhizogenes
21. Practical application of genetic transformation.

Environmental Biotechnology	Course Code:BBT-S630

Renewable and non-renewable resources
What is renewable should be bioassimiliable / biodegradable.
Major consumer items: food, fuel and fibers.
Conventional fues and their environmental impacts.

Modern fuels and their environmental impacts.
Biotechnology inputs in producing good quality natural fibres
Microbiological quality of food and water.
Treatment of municipal waste and industrial effluents
Degradation of pesticides and other toxic chemicals by Microorganism
Thurngiensis toxin as a natural pesticide.
Biological Control of other insects swarming the agricultural fields
Enrichment of ores by Microorganisms.
Biofertilizers, Nitrogen fixing microorganisms enrich the soil with assimilable nitrogen.