

## M.Sc. (Biotechnology) (MSCBT)

### SEMESTER I

#### MSCBT-101: Introductory Biology

1. Nature and Scope of Biology: Basis and origin of life, Living and non – living common features of life process. Energy Transformation.
2. Kingdoms of life, or Biological Classification, species and population, Biotic community, Biosphere.
3. Cell as a unit of life : Prokaryotic and Eukaryotic cell, Plant and animal cell, cell structure, membrane organization and cell organelles. Cell function, cell division mitosis and meiosis, cell cycle .
4. Introduction to Bio Molecules:  
Structure and properties of mono, oligo and poly Saccharides  
Structure and properties of fatty acids, glycerolipids, phospholipids, glycolipids, steroids.  
Structures and Properties of amino acids peptides and protein.  
Structure and properties of purines, Pyrimidines, nucleosides, nucleotides, polynucleotides, Ribonucleic acids and Deoxyribonucleic acids, nucleoprotein complexes.
5. Metabolism: Introduction of Respiration and Photosynthesis.

#### SEMESTER I

#### MSCBT-102: Molecular Biology - I

**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 : holliday model, Rec A, Rec BCD, gene conversion

## MSCBT-103: Bioenergetics & Metabolism

### Unit I

Introduction to Biochemistry, define Carbohydrate, nomenclature, classification, structure, chemistry and properties.

Biological functions of carbohydrate.

Carbohydrate metabolism : Basic concept, glycolysis, kreb cycle, pentose phosphate pathway and regulation.

Polysaccharides : Bacterial cell wall, peptidoglycans and glycolipid.

### Unit II

Lipid : Define Lipid, nomenclature, classification structure, chemistry and properties.

Lipids with specific biological function. Lipoproteins and biological membrane, micelles and liposomes.

Lipid metabolism : Biosynthesis and degradation of fatty acid.

Prostaglandins, leukotrienes and thromboxanes.

### Unit III

Amino acid : Structure, classification, properties and function.

Methods for isolation and characterisation of protein. Chemical Synthesis of peptides; study of specific

protein like haemoglobin, myoglobin and plasma protein.

Protein : Classification and properties.

Fluorimetric method for determination of N-terminal amino acid.

### Unit IV

Nucleic acid : Structure, chemistry and properties of purines, pyrimidines, nucleosides & nucleotides,

Polynucleotide.

Biosynthesis and degradation of purines and Pyrimidines.

Enzyme : Basic concept.

Vitamins and their deficiency.

### Unit V

First and second laws of thermodynamics & concept of free energy.

High energy phospho Compounds, ATP cycle, structural basis of free energy during hydrolysis of ATP.

Hormones : Hormones receptors and intracellular messengers, Adenylate cyclase, Protein kinase and phosphodiesterase.

Porphyrins : Classification and Structure.

## SEMESTER I

### MSCBT-104: Microbiology

#### Unit - 1:- THE WORLD OF BACTERIA:-

General characteristics & classification of bacteria according to Bergey's manual of systematic bacteriology.

Nutritional requirements & physical conditions necessary for cultivation of bacteria, properties of bacteriological media.

#### Unit II:- HISTORY AND SCOPE OF MICROBIOLOGY:- Milestone in Microbiology- Recent

development and future trends.

Anatomy of Prokaryotes & Eukaryotes-Morphology-ultrastructure of Bacteria, Fungi, Algae, Protozoa and Viruses.

#### Unit - III :- MICROBIAL METABOLISM & STAINING TECHNIQUES

Classification of bacteria on the basis of their nutritional requirements, transport of substances across membranes.

Procedure and principle involved in gram's staining, acid fast staining, flagella staining, endospore staining.

**Unit IV:- Microbial growth & nutrition :-** Definition of growth, mathematical expression of growth, measurement of growth field; synchronous growth, continuous culture, effect of environmental factor on growth.

**Unit V:- Microbial Ecology:-** Rhizosphere, phylloplane & role of microorganism in productivity of ecosystem. Interaction between microorganism, and with plants and animals.

Biogeochemical cycle.

Microbes & bio-deterioration.

## **SEMESTER I**

### **MSCBT-105: Biophysical Chemistry & Instrumentation**

#### **Unit I**

Electronic theory of valency dipole moment. Electron displacement, electronic effect, resonance. The hydrogen bond, hydrophobic interactions. Atomic theory and molecular orbital.

Hybridization.

Free radicals in biological systems, antioxidants.

Isomerism : Structural and stereoisomerism optical activity, meso compounds. Specific rotation, chirality,

chiral, enantiomers, conformation and configuration. Conformational analysis of monosaccharides, boat

and chair forms, eclipsed. Mutarotation, glycosides epimers.

#### **Unit II**

Centrifugation : Principle, types, analytical and prepared centrifugation, differential density, gradient

centrifugation, sedimentation and coefficient centrifuge and its application.

Electrophoresis : Principles, types and application (paper, starch, gel polyacrylamide and agar electrophoresis).

Chromatography : Principle type and application, (Paper, thin layer, gas ion exchange and molecular sieve).

Affinity chromatography, HPLC, FPLC.

#### **Unit III**

Photometry : Basic Principle of UV-Vis spectrophotometry and colorimetry.

Fluorimetry : Principle, instrument and application.

Flame techniques, atomic absorption spectroscopy.

Isoelectric focusing and Isotachopheresis.

#### **Unit IV**

Microscopy : Light, phase contrast, interference and electron microscopy.

X-ray crystallography.

Radioactivity : Radioisotopes, half life, units. Geiger Mueller counter.

Scintillation ; Liquid, Crystal and gamma counter.

#### **Unit V**

ESR : Principle, instrumentation and its application.

NMR : Principle, instrumentation and its application.

ORD and CD : Principle, instrumentation and its application.

Polarimetry : Principle, instrumentation and its application.

## **INSTRUMENTATION PRACTICAL**

### **Practical course of Semester I**

Verification of Beer's law.

Determination of absorption maxima.

Electrophoresis of Proteins - native and under denaturing conditions.

Amino acid and carbohydrate separations by paper and thin layer chromatography.

Separation of blood cells by density gradient centrifugation.

Chromatographic method for separation of macromolecules.

Separation of subcellular organelles by differential centrifugation.

Electrophoresis of DNA - linear, circular and super coiled.

## **SEMESTER I**

### **MSCBT-106: 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**

##### **MSCBT-107: Practical**

Introductory Biology : 15 Marks

Molecular Biology - I : 15 Marks

Bioenergetics & Metabolism : 15 Marks

Microbiology : 15 Marks

Biophysical Chemistry & Instrumentation : 15 Marks

Internal Assessment : 25 Marks

## SEMESTER II

### MSCBT-201: ENZYMOLOGY & ENZYME TECHNOLOGY

#### Unit I

- (i) Enzyme: Historical aspects, nomenclature and classification.
- (ii) General properties of enzymes and the factors that affect their activity and the associated changes.
- (iii) Extraction assay and purification of enzymes.
- (iv) Sub-cellular localization and organization of enzymes

#### Unit II

- (i) Enzyme kinetics (steady state), determination of  $K_m$  value and studying, kinetics using, Lineweaver-Burke plot, Eadie Hofstee plot and Hans-Woolf equations.
- (ii) Enzyme inhibitors-Presteady state kinetics-fast kinetics to elucidate the intermediate and rate limiting steps (flow and relaxation techniques)Complex kinetics and analysis.
- (iii) Allosteric enzyme.
- (iv) Rapid reaction techniques.

#### Unit III

- (i) Enzyme specificity- Evidences for enzyme substrate complex Nucleophilic and electrophilic attack - Role of metal ions in enzyme catalysis.
- (ii) Mechanism of enzyme action - (lysozyme, chymotrypsin), DNA polymerase, .Rnase etc. zymogens and enzyme activators, active site determination.
- (iii) Regulations of enzymes
- (iv) Allosteric interactions and product inhibition.

#### Unit IV

- (i) Coenzymes
- (ii) Isoenzymes & metalloenzymes .
- (iii) Membrane bound enzymes-their extraction assay.
- (iv) Lipid-protein interaction and the effect of fluidity on enzyme activity.

#### Unit V

- (i) Immobilisation ; Principle, kinetics of immobilised systems.
- (ii) Enzyme immobilisation : Principle, method, activity and application.
- (iii.) Effect of immobilization on : activity, kinetics parameters and stability
- (iv) Application of immobilized enzyme.

#### Practical

- Q1. Study of transduction, transformation, conjugation in E.coli.
- Q2. Study of mutation in E.coli.
- Q3. Assay of Enzyme activity.
- Q4. Kinetic studies on enzyme.
- Q5. Alkaline phosphatase estimation.
- Q6. Elisa test
- Q7. Immobilization of Enzymes.
- Q8. Urease estimation by colorimetric method.

### MSCBT-202: BIOINFORMATICS

Overview of Bio-Informatics- Database types, sequence database-nucleotide and protein sequence database, primary and secondary database, Gene Bank, Structure database-protein Data Bank (PDB),

Visualization of structural information, Genomics and the genome. Project sequencing and sequence assembling using computers.

## SEMESTER II

### MSCBT-203: MOLECULAR BIOLOGY-II

#### Unit - I :- TRANSPOSABLE GENETIC ELEMENTS

Discovery & definition of transposons, simple transposons ( IS elements ), composite transposons (Tn3, Tn5, Tn9, Tn10 ), Ac/Ds elements in maize, P elements in drosophila, Retxotransposons, mechanisms of transposition.

Unit II:- Gene Expression:- Structure, classes & function of RNA. RNA transcription and processing in Eukaryotes and prokaryotes genetic code and protein synthesis Transcription and translational controls.

Unit III:- Regulation of Gene Expression- The operon concept regulatory gene, promoter gene, operator gene and structural gene, role of CAMP and CRP in gene expression, catabolite repression, induces, repressor corepressor. Brief account of Eukaryotic gene expression (Britson & Davidson model). Protein localization: synthesis of secretory and membrane protein.

Unit IV:- Gene as unit of Mutation & Recombination :-

Physical and Chemical Basis of Mutation: Mechanism of mutagenesis, Mutation of DNA & protein levels.

Recombination in Bacteria - Transformation, transduction and conjugation, mechanism of gene transfer and application.

Unit V:- Oncogenes and their properties ; classification, characteristics and significance in development,

Differentiation and Carcinogens . An overview of Apoptosis its phases and significance, Apoptosis in pathogenesis & therapeutic implication.

#### Practical

Q1. Isolation of genomic DNA from bacterial cells.

Q2. Isolation of plasmid DNA from bacterial cells.

Q3. Isolation of genomic DNA from plant cells.

Q4. Transformation of CaCl<sub>2</sub>

### MSCBT-204: GENETIC ENGINEERING

#### Unit I

Core techniques in gene manipulation ; Cloning strategies ; Construction of gene libraries; Probe

construction; recombinant selection and screening -DNA sequencing, RFLP, DNA finger printing;

Expression analysis; sequencing mutagenesis Engineering genes; Polymerase chain reaction; Ligase chain reaction.

#### Unit II

Expression systems and their applications; Production of protein from cloned genes; gene cloning in research, medicine and agriculture; Intellectual Property Rights (IPR) and patents, biosafety, containment facilities for

Genetic Engineering experiments. Regulations on field experiments and release of GMO's (Genetically Modified Organisms), labelling of GM (Genetically Modified) Foods. '

#### Unit III

E.Coli vectors - Plasmid biology - pBR 322 and its derivatives - gene markers. Cloning vectors for gramnegative bacteria & phage - filamentous phages - Cosmid - phasmid. Cloning in Gram - Positive bacteria Bacillus subtilis - transformation techniques.

#### Unit IV

Gene expression in eukaryotes - Cloning in Yeast Saccharomyces cerevisiae genetics - life cycle - types of vectors - gene expression system. Eukaryotic Vectors - SV40 - molecular genetics - markers - expression system. Cloning and gene expression in Streptomyces. Specialised cloning vectors for cDNA - synthesis of specific RNA in vitro- selection of vectors for copy number - cloning promoters and Terminators.

#### Unit V

Plant cloning vectors - Agrobacterium turnefaciens - Ti piasmids -molecular genetics and gene expression. Animal cell cloning; vectors - Baculoviruses - mammalian expression, vectors. - retroviral vectors

Expression vectors - vectors for fusion protein - promoters - translation proteases - gene fusion - secretion - modification and protein refolding -inducible - constitutive expression cassettes.

#### Practical

Q1. Study of transduction, transformation, conjugation in E.coli.

Q2. Study of mutation in E.coli.

#### MSCBT-205: PRACTICAL

Enzymology & Enzyme Technology - 20 Marks

Bioinformatics - 15 Marks

Molecular Biology - II - 20 Marks

Genetic Engineering - 20 Marks

Internal Assessment - 25 Marks

## SEMESTER III

### MSCBT-301: Immunology

#### Unit I

Immune response : Type of Immunity, Antigens and haptens.

Anatomy of lymphoid organs; primary and secondary lymphoid organs.

Immunoglobulin Structure, function and synthesis, memory cells lymphocyte differentiation.

Cell of the immune system : Mononuclear cells and granulocytes, Lymphocytes and their subsets.

#### Unit II

Biology of complement systems : structure and function of MHC class I & II molecules.

Antigen recognition and presentation, cell mediated immune responses.

Hypersensitivity reactions; Immune suppression and Immune Tolerance immune disorders, Transplantation.

Role of complement system in immune responses.

#### Unit III

Antigen - Isolation, purification and characterization of various antigens and haptens from pathogens

and other biological molecules by biophysical and chemical and affinity separation methods.

Production of antibodies, purification of antibodies, Quantitation of immunoglobulin by RID, EID and

nephelometry. Hybridoma and monoclonal antibody production.

Immuno-diagnosis and Applications of monoclonal antibodies in biomedical research; human monoclonal antibodies, Catalytic antibodies; complement fixation test; assessment of immune complex in tissues.

#### Unit IV

Purification of mononuclear from peripheral blood; isolation and characterization of T cell subsets; B

cells and macrophages.

Fluorescent Activated cell sorter (FACS); Mitogen and Antigen induced Lymphoproliferation assay. Cell

mediated Lympholysis; Mixed Lymphocyte reaction.

Assessment of delayed hypersensitivity reactions; Macrophage cultures.

Assay for Macrophage activation; Isolation of dendritic cells; In situ and in vivo characterization of cells

from tissues; Generation of T cell HLA typing.

#### Unit V

Cytokines : Structure and functions, Cytokine receptors, Biology and assay of cytokines.

Cytotoxic

Tcells and their mechanism of action, NK cells and mechanism of target cell destruction.

Vaccine

technology including DNA vaccines; identification of T & B epitopes for vaccine developments, Immunotechnology and infectious diseases. Immunoscreening of recombinant library.

#### Practical

Q1. Blood film preparation and identification of cells.

Q2. Separation of serum proteins by electrophoresis.

Q3. Study of antigen and antibody interaction by double diffusion method.

Q4. Study of antigen and antibody interaction by immuno-electrophoresis.

Q5. Study of antigen and antibody interaction by counter-current immuno-electrophoresis.

### **MSCBT-302: Plant Biotechnology**

Plant genome organisation, structure of representative plant genes and gene families in plants -

Organisation of chloroplast genome, nuclear encoded and chloroplast encoded genes for chloroplast proteins, targeting of proteins to chloroplast - Organisation of mitochondria! genome - encoded genes for mitochondrial proteins - RNA editing for plant mitochondria -cytoplasmic male sterility - Seed storage proteins - maize transposable elements, their organisation and function, transposable elements in transgenic plants - Regulation of gene expression in plant development -Plant hormones and phytochrome.

#### **Unit II**

Symbiotic nitrogen fixation in legumes by Rhizobia - Nitrogen fixation in Cyanophyta. the biochemistry,

molecular biology and gene rearrangement. Agrobacterium and crown gall tumors -

Mechanism of TDNA

transfer to plants, Ti plasmid vectors and its utility - Classification and molecular biology of plant

viruses - Molecular biology of -plant stress response. Transgenic plants and applications vaccine and

other biological developments.

#### **Unit III**

Genetic engineering in plants, selectable' markets, reporter genes and promoter used in plants by

physical means - Genetic engineering of plants for construction of genome libraries and CDNA libraries,

Molecular breeding.

#### **Practical**

Preparation of fissure culture medium for plants

Preparation of single cell suspension from spleen or thymus & plants.

Protoplast fusion.

Cell counting & cell viability .

Callus Propagation, organogenesis, transfer of plant to soil.

### **SEMESTER III**

#### **MSCBT-303: Environmental Biotechnology**

##### **Unit-I**

Environment: basic concepts and issues ; environmental pollution : types and methods for the measurement; methodology of environmental management- problem solving approach, its limitations;

air pollution and its control through biotechnology, air sampling techniques; biodiversity : conservation and management.

##### **Unit - II**

Water pollution and its control: water as a scarce natural resource, need for water management,

sources and measurement of water pollution, waste water treatment-physical, chemical and biological treatment processes; algal blooms and human health.

##### **Unit-III**

Microbiology of waste water treatments : aerobic process- activated sludge, oxidation switches, trickling filter, towers, rotating discs, rotating drums, oxidation ponds; anaerobic processes- anaerobic

digestion, anaerobic filters, upflow anaerobic sludge blanket reactors;  
treatment schemes for waste waters of dairy, distillery, tannery industries; biotechnological applications of microbes from extreme environment.

Unit-IV

Microbial degradation of xenobiotics in the environment - ecological considerations, decay behaviour & degradative plasmids, hydrocarbons, substituted hydrocarbons, oil pollution, surfactants, pesticides; bioaccumulation of metals and radio-nuclerds and detoxification ; bioremediation.

Unit-V

Biological N<sub>2</sub> fixation, H<sub>2</sub> production, biofertilizers and biopesticides; solid wastes: sources and management (composting, wormiculture and methane production). Single cell protein (Spin/Una, yeast, mushroom); global environmental problems- ozone depletion, UV-B, green house effect and acid rain, their impact and. biotechnological approaches for

**Practical**

Isolation of industrially important microorganism for microbial processes.

Determination of thermal death point (TDP) and thermal death time (TDT) of microorganism for design of a sterilizer.

Comparative study of Ethanol production using different substrate .

### **SEMESTER III**

#### **MSCBT-304: Bioprocess Engineering & Technology**

Unit-I

Introduction to bioprocess engineering, bioreactors, isolation, preservation and maintenance of industrial

microorganisms; kinetic of microbial growth and death; media for industrial fermentation, air and media

sterilization.

Unit - II

Types of fermentation processes, analysis of batch, fed-batch and continuous bio-reactides, stability of microbial reactors, analysis of mixed microbial populations, specialized bioreactors (pulsed, fluidized, photobioreactors etc.); measurement and control of bioprocess parameters.

Unit - III

Downstream processing: introduction, removal of microbial cells and solid matter, foam reparation,

precipitation/filtration, centrifugation, cell disruptions, liquid-liquid extraction, chromatography; membrane process, drying and crystallization; effluent treatment- D.O.C. and C.O.D. treatment and disposal of effluents; whole cell immobilization and their industrial applications.

Unit - IV

Industrial production of chemicals: alcohol (ethanol), acids (citric acetic and gluconic) solvents, (glycerol acetone butenol) , antibiotics (penicillin), amino acids (lysine), single cell-protein.

Unit - V

Use of Microbes in mineral beneficiation and oil recovery; Introduction to food technology:

Elementary idea of canning and packing, sterilization and pasteurization of food products, technology of typical food /

food products( Bread, Cheese, Idli ), food Preservation.

**Practical**

Isolation of antibiotic producing microorganism from soil.

Use of alginate for cell immobilization.

Detection of coli—for determination of purity of potable w—.  
Determination of COD/BOD for a sewage sample.  
Determination of the efficiency of removal of air. Pollutant by using air samples.  
Test for the degradation of aromatic hydrocarbon by bacteria.

### **SEMESTER III**

#### **MSCBT-305: Practical**

Immunology : 20 Marks

Plant Bio-Technology : 15 Marks

Environmental Biotechnology : 20 Marks

Bioprocess Engineering & Technology : 20 Marks

Internal Assessment : 25 Marks

### **SEMESTER IV**

#### **MSCBT-401: Biostatistics**

Unit I:- Introduction:- definition, scope and limitation of biostatistics; concept of variables in biological systems; collection, classification, tabulation, graphical diagrammatic representation of data, Measures

of central tendency (arithmetic, harmonic & geometric), median and mode; confidence limit of population mean.

Unit II:- Measure of dispersion: range, standard deviation variance, coefficient of variation; definition and

basic properties of probability, normal and binomial distribution function, test of significance, hypothesis, error, level of significance; t-statistics: test that a population mean equals a specified

value, paired 't' test.

Unit III:- F-statistics: one way analysis of variance (sample size equal and unequal), chi-square statistics, test of goodness of fit, test of independence of factor; co-relation and its coefficient/ linear

regression and its coefficient regression equation & its diagram.

Unit IV:- Introduction to data base concept, introduction to internet and its application, introduction to MS office software, covering word processing, spreadsheets, introduction to hardware graphics.

Unit V:- Computer oriented statistical techniques by using Excel; frequency table of single discrete variable, computation of mean, variance and standard deviation;

### **SEMESTER IV**

#### **MSCBT-402: Animal Biotechnology**

Unit - I

Basic principles of Biotechnology as applicable to animal Science -

Artificial Insemination, pregnancy diagnosis, In-vitro fertilization - Embryo

Transfer Technology - Transgenic Animals.

Unit - II

Animal Cell culture - Applications

in Animal biotechnology. Bio hazard and Biosecurity in Animal Biotechnology-

Ethical aspects in Animal Biotechnology.

Unit - III

Biofueling and Control technology. Bioremediation. Use transgenic technology to study fish growth and development

Unit IV

Genetic engineering and ploidy manipulation to enhance grow reproduction and development of disease resistance in aquaculture species. Cryobiology in Marine germplasm preservation Pharmaceuticals from marine organisms.

#### **SEMESTER IV**

##### **MSCBT-403: 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 IV**

##### **MSCBT-404: 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 IV**

**MSCBT-405: Practical / Training**

Biostatistics : 20 Marks

Animal Biotechnology : 20 Marks

Pharmaceutical Biotechnology : 15 Marks

Research Methodology : 20 Marks

Internal Assessment: 25 Marks