

**MASTER OF SCIENCE (BIOTECHNOLOGY)  
REGULATIONS**

**ELIGIBILITY**

A pass in any one of the following Degree Courses of B.Sc. Biotechnology / Biology / Agriculture / Botany / Zoology / Plant Science / Microbiology / Animal Sciences / Biochemistry / Bioinformatics / Environmental Science / Food and Nutrition of any University in Tamil Nadu or an Examination accepted as equivalent thereto by the Academic Council, subject to such conditions as may be prescribed thereto are permitted to appear and qualify for the **M.Sc., Biotechnology Examination** of this College after a course study of two academic years.

**OBJECTIVES OF THE COURSE**

1. This programme will enable students to acquire knowledge on the fundamentals of Biochemistry, Cell biology, Microbiology and Molecular biology to enable them to understand emerging and advanced concept in modern biology and help them to take up their carrier in this field.
2. This programme will facilitate the students to acquire knowledge in fields such as Genetic Engineering, Protein Engineering, and Bioprocess Engineering and associated Downstream processing enabling their application through Bioprocess technology.
3. The programme will aid the students to learn the recent developments in the field of Genomics, Proteomics, Cancer Biology and modern drug discovery approach. It will also empower the students to have advanced focus on the molecular basis of diseases and development of advanced therapeutics.

M.Sc Biotechnology (Students admitted from 2015-2016 onwards)

**SCHEME OF EXAMINATION**

Subject Code	Subject	Hrs of Instruction	Exam Duration (Hrs)	Max Marks			Credit Points
				CA	CE	Total	
<b>First Semester</b>							
15PBT13A	Cell and Molecular Biology	5	3	25	75	100	4
15PBT13B	Biochemistry	5	3	25	75	100	4
15PBT13C	Genetics	5	3	25	75	100	4
15PBT13D	Microbiology	5	3	25	75	100	4
15PBT13P	Core Practical- I	5	6	40	60	100	4
	Elective -I	5	3	25	75	100	4
		<b>30</b>				<b>600</b>	<b>24</b>
<b>Second Semester</b>							
15PBT23A	Immunology	5	3	25	75	100	4
15PBT23B	Genomics and Proteomics	5	3	25	75	100	4
15PBT23C	Genetic Engineering	5	3	25	75	100	4
15PBT23D	Bioprocess Technology	5	3	25	75	100	4
15PBT23P	Core Practical- II	5	6	40	60	100	4
	Elective- II	5	3	25	75	100	4
		<b>30</b>				<b>600</b>	<b>24</b>
<b>Third Semester</b>							
15PBT33A	Molecular Diagnostics	5	3	25	75	100	4
15PBT33B	Plant Biotechnology	5	3	25	75	100	4
15PBT33C	Animal Biotechnology	5	3	25	75	100	4
15PBT33D	Environmental Biotechnology	5	3	25	75	100	4
15PBT33P	Core Practical - III	5	6	40	60	100	4

BoS Chairman/HoD  
Department of Biotechnology  
Dr. N. G. P. Arts and Science College  
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Coimbatore - 641 048  
Tamilnadu, India

**M.Sc Biotechnology (Students admitted from 2015-2016 onwards)**

15PBT33T	Industrial/ Institutional Training	--	--	--	--	50	2
	Elective- III	5	3	25	75	100	4
		<b>30</b>				<b>650</b>	<b>26</b>
<b>Fourth Semester</b>							
15PBT43A	Research Methodology	5	3	25	75	100	4
15PBT43V	Project	20	-	80	120	200	8
	Elective -IV	5	3	25	75	100	4
		<b>30</b>				<b>400</b>	<b>16</b>
<b>Grand Total</b>						<b>2250</b>	<b>90</b>

**\* Student shall undergo Training for period of not less than 15 days during third Semester and report has to be submitted for Viva-voce examination (External Evaluation).**

**M.Sc Biotechnology (Students admitted from 2015-2016 onwards)**

**ELECTIVE - I**

(Student shall select any one of the following subject as Elective in first semester)

<b>S.No</b>	<b>Subject Code</b>	<b>Name of the Subject</b>
1.	15PBT1EA	Biomaterials
2.	15PBT1EB	Biodiversity

**ELECTIVE - II**

(Student shall select any one of the following subject as Elective in second semester)

<b>S.No</b>	<b>Subject Code</b>	<b>Name of the Subject</b>
1.	15PBT2EA	Bioethics, Biosafety and IPR
2.	15PBT2EB	Protein Engineering

**ELECTIVE - III**

(Student shall select any one of the following subject as Elective in third semester)

<b>S.No</b>	<b>Subject Code</b>	<b>Name of the Subject</b>
1.	15PBT3EA	Stem Cell Biology and Tissue Engineering
2.	15PBT3EB	Principles of Clinical Trails

**ELECTIVE - IV**

(Student shall select any one of the following subject as Elective in fourth semester)

<b>S.No</b>	<b>Subject Code</b>	<b>Name of the Subject</b>
1.	15PBT4EA	Pharmaceutical Biotechnology
2.	15PBT4EB	Food Biotechnology

**Total Credit Distribution**

Subjects	Credits	Total		Credits	Cumulative Total
Core	4	13 x 100 =	1300	52	74
Core Lab	4	3 x 100 =	300	12	
Industrial/ Institutional Training	2	1 x 50 =	50	02	
Project	8	1 x 200 =	200	08	
Elective	4	4 x 100 =	400	16	16
<b>Total</b>			<b>2250</b>	<b>90</b>	<b>90</b>

**FOR COURSE COMPLETION**

Students have to complete the following Subjects:

- Core papers in I, II, III and IV Semesters.
- Elective papers in the I, II, III and IV Semesters.
- Core practical's in I, II and III Semesters.
- Institutional/Industrial Training in III Semester
- Project and Viva - Voce in IV Semester

<b>15PBT13A</b>	<b>CELL AND MOLECULAR BIOLOGY</b>	<b>SEMESTER - I</b>
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**Total Credits: 4**  
**5 Hours / Week**

### **OBJECTIVES:**

The major objective of this subject is to provide

1. The Basic concepts of Cells.
2. The Basis of regulatory mechanisms of cells

### **CONTENTS**

#### **UNIT- I**

Discovery of the cells, classification of cell types, development of cell theory. Prokaryotic and Eukaryotic cell organization. Membrane architecture. Active, Passive diffusion and osmosis.

#### **UNIT- II**

Structure and Function of Ribosome, Mitochondria, Chloroplast, Golgi apparatus, lysozymes and micro bodies, endoplasmic reticulum, vacuoles, peroxysomes and Nuclear compartment. Heterochromatin and euchromatin, polytene chromosomes.

#### **UNIT- III**

DNA: Evidence of DNA as genetic material, Physical structure, Nucleosomes, Forms of DNA, Gene structure. DNA Replication- Replication mechanisms and machinery, DNA repair systems.

#### **UNIT- IV**

Transcription: in eukaryotes and prokaryotes. Inhibitors of Transcription. Processing of mRNA, rRNA and tRNA. Translation: Genetic code, Initiation, elongation and Termination, Post transcriptional and post translational modification.

#### **UNIT- V**

Regulation of gene expression: Negative control (*Lac* operon), Positive control (*Arabinose* operon, *Trp* Operon), Recombination, Mutation. Eukaryotic gene regulation.

**TEXT BOOKS:**

1. *Lewin, B.* 2004. **Genes V.** Oxford University press.
2. *Freifelder, D. and Malacinski, G. M.* 1996. **Essential of Molecular Biology**, 2<sup>nd</sup> edition. Panima Publishing Co., New Delhi.

**REFERENCE BOOKS:**

1. *Lewin, B.* 2004. **Genes VIII.** Oxford University press.
2. *Lodish, H., Berk, A., Zipursky, L., Matsudaira, P., Baltimore, D. and Darnell, J.,* 2000. **Molecular Cell Biology.** 4<sup>th</sup> edition. WH Freeman & Co, New York.

<b>15PBT13B</b>	<b>BIOCHEMISTRY</b>	<b>SEMESTER - I</b>
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**Total Credits: 4**  
**5 Hours / Week**

**OBJECTIVES:**

1. The students will understand the Structure, function and interrelationship of various bio molecules & consequences of deviation from normal.
2. Integration of the various aspects of metabolism and their regulatory pathways.
3. Recognize the value of the importance of biochemistry in everyday life in the 21<sup>st</sup> century.

**CONTENTS**

**UNIT- I**

Structure of atoms, molecules and chemical bonds; Classes of organic compounds and functional groups. Covalent and Noncovalent interactions - Vander Waals, Electrostatic, Hydrogen bonding and hydrophobic interactions; Energy metabolism (concept of free energy); Principles of thermodynamics.

**UNIT- II**

Enzyme Nomenclature, Active sites; Enzymes and coenzymes: Coenzymes interactions: activators and inhibitors, kinetics of enzyme inhibitors, isoenzymes, allosteric enzymes; Ribozyme, Abzyme: structure and drug targets (enzymes and receptors).

**UNIT- III**

Carbohydrates - classification, occurrence, isolation, purification, properties and biological reactions. Glycolysis and TCA cycle; Glycogen breakdown and synthesis; Gluconeogenesis; interconversion of hexoses and pentoses.

**UNIT- IV**

Oxidation of fatty acids; Biosynthesis of fatty acids; Triglycerides; Phospholipids; Sterols. Amino acids and Structure of proteins, structural comparison at secondary and tertiary levels (Ramachandran plot).



## UNIT- V

Classification, structure, functions and reactions of nucleic acids, Biosynthesis of Purines and pyrimidines, Salvage pathway, Regulation of Purine and pyrimidine biosynthesis.

### TEXTBOOKS:

1. *Geoffery L Zubay*. 1995. **Principles of Biochemistry**. WCB publishers, London.
2. *Ambika Shanmugam*. 2012. **Fundamentals of Biochemistry**. 7<sup>th</sup> edition. Lippincott Williams & Wilkins.

### REFERENCES:

1. *Lehninger Albert. L , Nelson David. L and Cox Michael M*,1993. **Principles of Biochemistry**. 2<sup>nd</sup> edition. CBS Publishers And Distributors, New Delhi.
2. *Voet, D. and Voet, J. G.* 1995. **Fundamentals of Biochemistry**. 2<sup>nd</sup> edition. John Wiley and sons inc., New York.

<b>15PBT13C</b>	<b>GENETICS</b>	<b>SEMESTER - I</b>
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**Total Credits: 4**  
**5 Hours / Week**

### **OBJECTIVES:**

The students will understand the

1. Basic vocabulary of genetics.
2. Mendelian and non Mendelian modes of inheritance that govern passage of genetic traits across generation.
3. Causes and consequences of variations in chromosome structure and number.

### **CONTENTS**

#### **UNIT-I**

Mendel's work: Monohybrid Experiment, Dihybrid Experiment, Chromosomal theory of Inheritance, Extra chromosomal Inheritance, Multiple Alleles: Independent assortment (Back Cross and Test Cross), Pseudoalleles, Complementation Test.

#### **UNIT-II**

Concept of Gene, Genetic Interactions: Co-Dominance, Incomplete Dominance, Pseudo dominance, Epistasis, Lethality and Lethality genes, Maternal effects and maternal effect genes, transformation, conjugation and transduction, Transposable elements of Prokaryotes and Eukaryotes.

#### **UNIT-III**

Structure of Prokaryote and Eukaryote chromosome, Mitochondrial genome, Chloroplast Genome, Linkage and Crossing over: Mechanism of crossing over, Advantages of crossing over, Chromosome mapping.

#### **UNIT-IV**

Concept of sex determination and patterns in plants and animals; sex chromosomes; sex determination in flowering plants; Chromosomal Variations: Numerical - euploidy and aneuploidy; Structural - deletion, duplication, inversion and translocation.

## UNIT-V

Model organism for genetic analysis of development- *Drosophila* & *Arabidopsis*, Population Genetics: Gene frequency, Calculation of Gene frequency, Pedigree analysis, Genetic Counseling.

### TEXT BOOKS:

1. *Strickberger, M. W.* 2013. **Genetics**. 3<sup>rd</sup> edition. Prentice Hall College Division, New Delhi.
2. *Gardner, E. J.* 1991. **Principles of Genetics**. 8<sup>th</sup> edition. John Wiley and Sons Inc, New York.

### REFERENCE BOOKS:

1. *Winter, P. C., Hickey, G. I. and Fletcher, H. L.* 2000. **Genetics**. 1<sup>st</sup> edition. Viva Books Pvt Ltd., New Delhi.
2. *Brown, T. A.* 1999. **Genetics**. 3<sup>rd</sup> edition. Chapman and Hall, London.

<b>15PBT13D</b>	<b>MICROBIOLOGY</b>	<b>SEMESTER - I</b>
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**Total Credits: 4**  
**5 Hours / Week**

**OBJECTIVES:**

The objective of the course is to

1. Define the science of microbiology and describe some of the general methods used in the study of microorganisms.
2. Describe some of the various activities of microorganisms that are beneficial to humans.
3. Demonstrate appropriate laboratory skills and techniques related to the isolation, staining, and identification, assessment of metabolism and control of microorganisms.

**CONTENTS**

**UNIT-I**

Introduction to Microbiology. Working principle and construction of bright field, dark field, phase contrast, Fluorescent and Electron microscopy. Structure and reproduction of Bacteria, Fungi, Viruses.

**UNIT-II**

Cultivation of bacteria- culture media and methods. Measurement of bacterial growth. Bacterial growth curve, Factors influencing microbial growth. Environmental and nutritional factors. Nutritional types of bacteria. Microbial locomotion - flagellar motility, gliding motility and amoeboid motion. Chemotaxis, Phototaxis and other taxes.

**UNIT-III**

Identification of bacteria. Staining reactions. Cultural, physiological and biochemical characteristics. Sterilization - Principles and methods, physical and chemical methods. Antibiotics - mechanism of action. Drug resistance in bacteria. Antibiotic sensitivity tests.

**UNIT-IV**

Brief account of microbial interactions (symbiosis, neutralism, commensalism, competition, ammensalism, synergism, parasitism and

predation); Biological nitrogen fixation - symbiotic and asymbiotic; Biofertilizers, Biological Pest control. Carbon, Nitrogen, Phosphorus and Sulphur cycles.

#### UNIT-V

Microbial agents of diseases- Bacteria (typhoid, cholera and tuberculosis), virus (rabies, polio, HIV Hepatitis) and fungi( dermato mycoses, systemic mycoses).

#### TEXT BOOKS:

1. *Arti Kapil(Ed.)*. 2013. **Ananthanarayan and Panicker's Textbook of Microbiology**. 9<sup>th</sup> edition. Orient Black Swan Pub.
2. *Michael J. Pelczar Jr.* 2001. **Microbiology**. 5<sup>th</sup> edition. McGraw Hill Education (India) Pvt Ltd.

#### REFERENCES:

1. *Presscott, L. M., Harley, J. P. and Klein, D. A.* 2005. **Microbiology**. 6<sup>th</sup> edition. Tata Mc Graw Hill, New Delhi.
2. *Alcamo, E.* 2001. **Fundamentals of Microbiology**. 6<sup>th</sup> edition. Jones and Bartlett Publishers, New Delhi.

<b>15PBT13P</b>	<b>CORE PRACTICAL- I</b>	<b>SEMESTER - I</b>
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**Total Credits: 4**  
**5 Hours / Week**

1. Estimation of protein by Lowry's method.
2. Estimation of reducing sugar by DNS method.
3. Estimation of total sugar by Anthrone method.
4. Estimation of DNA by diphenyl amine method.
5. Estimation of RNA by Orcinol method.
6. Amino acids separation by Paper chromatography and TLC.
7. Isolation of Auxotrophic Mutants.
8. Sex chromatin observation from Buccal smear.
9. UV- Mutagenesis.
10. Enumeration of Bacteria, Fungi and Actinomycetes from soil.
11. Bacterial staining - Simple, Gram and Spore.
12. Fungal staining (Lactophenol Cotton Blue).
13. Bacterial growth curve.
14. Antibiotic sensitivity test.
15. Carbohydrate fermentation test.
16. IMViC Test
17. TSI test

**REFERENCE BOOKS:**

1. *Sadasivam, S. and Manickam, A.* 1996. **Biochemical Methods**, New Age International.
2. *James G. Cappuccino & Natalie Sherman.* 1991. **Microbiology: A laboratory Manual**. Benjamin-Cummings Pub Co.
3. *Kannan, N.* 2002. **Laboratory Manual in General Microbiology**. Panima Publishers.

<b>15PBT1EA</b>	<b>ELECTIVE- I: BIOMATERIALS</b>	<b>SEMESTER - I</b>
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**Total Credits: 4  
5 Hours / Week**

**OBJCETIVES:**

1. To study the various biologically derived materials.
2. To study the various industrially important biopolymers.

**CONTENTS**

**UNIT-I**

Definition of biomaterials – biologically derived materials or materials compatible with biology. Common biomaterials: proteins, carbohydrates and specialized polymers. Collagen: Structure, production and its uses.

**UNIT-II**

Fibroin (protein in silk): Production and its use. Production of polymer proteins by conventional cloning methods. Biodegradable polymers.

**UNIT-III**

Carbohydrates: Modified carbohydrates; Actin gas lubricants for biomedical applications; Bacterial Polydextrose; Carbohydrates modified from enzymes; artificial wood.

**UNIT-IV**

Biopolymers: Synthesis from a simple biological monomer - hyaluronate polymer; Dextran, Rubber produced by bacteria and fungi, PHB, PCL; Production of a copolymer of PHB and PHV.

**UNIT-V**

Industrial biopolymers: Production of polyphenol resins by the enzyme soybean peroxidase; Evaluation of the properties of biopolymers to make good biomaterials; Visco -elastic properties; viscosity.

**TEXTBOOKS:**

1. *Glick Bernard, R. and Pasternak Jack, J.* 1996. **Molecular biotechnology**, Panima Publishing Corporation, New Delhi.
2. *Ratledge, C. and Kristiansen, B.* 2001. **Basic Biotechnology**, 2<sup>nd</sup> edition. Cambridge University Press.

**REFERENCE BOOKS:**

1. *Doi, Y.* 1990. **Microbial Polyesters**. VCH Weinheim Publishers.
2. *Joon Park and Lakes R. S.,* 2007. **Biomaterials: An Introduction**. 3<sup>rd</sup> edition. Springer Verlag Publishers.



<b>15PBT1EB</b>	<b>ELECTIVE- I: BIODIVERSITY</b>	<b>SEMESTER - I</b>
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**Total Credits: 4**  
**5 Hours / Week**

**OBJECTIVES:**

1. To study about the types and conservations of Biodiversity
2. To learn the ethical issues in Biodiversity

**CONTENTS**

**UNIT-I**

Basic concepts of Biodiversity - What is Biodiversity, Elements of Biodiversity - Ecosystem Diversity, Genetic Diversity, Species Abundance & Diversity, Patterns of Species Diversity.

**UNIT-II**

Aquatic common flora and fauna in India - phytoplankton, zooplankton and macrophytes, terrestrial common flora and fauna in India - forests, endangered and threatened species.

**UNIT-III**

Conservation of biodiversity - Overexploitation threatening living species, International Trade, Animals threatened by International trade, Problems in Controlling International Trade (Enforcement, Reservations, Illegal Trade), Free Trade and the Environment, Common patterns of Overexploitation.

**UNIT-IV**

International conventions, treaties and protocols for Biodiversity Conservation, Biodiversity in the welfare of mankind, Species concept, Biological nomenclature theories of biological classification.

**UNIT-V**

Bioethics - legal and socioeconomic impacts of biotechnology- ethical concerns of biotechnology research and innovation, Bioethics committees.

**TEXT BOOKS:**

1. *Sharma, P.D.* 1990. **Ecology and environment.** Rastogi publications, Meerut.
2. *Verma, P.S. and Agarwal, V.K.* 1996. **Principles of Ecology.** S.Chand & co., New Delhi.

**REFERENCE BOOKS:**

1. *Clarke, G.L.* 1954. **Elements of Ecology.** John Wiley & sons Publisher.
2. *Odum, E.P.* 1971. **Fundamentals of Ecology.** W.B. Saunders Company.

15PBT23A	IMMUNOLOGY	SEMESTER - II
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**Total Credits: 4**  
**5 Hours / Week**

### **OBJECTIVES:**

The students will understand the basic concepts of

1. The Cells of immune system
2. The regulation of immune systems
3. The techniques in immunology

### **CONTENTS**

#### **UNIT-I**

History and scope of immunology. Types of Immunity: Passive, Active and Acquired immunity. Humoral, Cell Mediated immunity. Cells and organs of immune response and their functions. Antigens. Types, haptens, epitopes and Factors influencing antigenicity. Antibodies Structure types, properties and functions of immunoglobulins.

#### **UNIT-II**

T-Cells, B-Cells, antigen presenting cells, cell mediated subset of T- Cells - helper and suppressor cells, natural killer cells. Lymphoid organs (primary and secondary) MHC molecules, Antigen presentation, B cell and T cell activation, cytokines. Complement system - Structure, components, properties and functions.

#### **UNIT-III**

Antigen antibody reactions. Immuno-electrophoresis, Hemagglutination, RIA, ELISA and immuno-fluorescent techniques. Blood cell components, ABO blood grouping, Rh typing. Hybridoma technology- production of monoclonal antibodies and their applications. Human monoclonal catalytic antibodies and plantibodies.

#### **UNIT-IV**

Hypersensitivity reactions, autoimmune disorders, deficiencies (Primary and secondary) and immuno tolerance. Vaccines and immunization: passive and Active immunization.

## UNIT-V

Tumor immunology: tumor antigens, immune responses and therapy, Transplantation Immunology. Types of Carcinogens- Chemical and Physical, Mechanism of Carcinogenesis. Different forms of therapy, chemotherapy, radiation therapy, detection of cancers.

### TEXT BOOKS:

1. *Janis Kuby*. 1997. **Immunology**. WH Freeman & Company, New York.
2. *Rober, A. Weinberg*. 2013. **The Biology of Cancer**. Garland Science.

### REFERENCE BOOKS:

1. *Ivan Riot*. 1988. **Essentials of Immunology**. 6<sup>th</sup> edition. Blackwell Scientific Publications, Oxford.
2. *Harlow and David Lane*. 1988. **Antibodies A laboratory Manual**. Cold spring Harbor laboratory Press.

<b>15PBT23B</b>	<b>GENOMICS AND PROTEOMICS</b>	<b>SEMESTER - II</b>
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**Total Credits: 4**  
**5 Hours / Week**

**OBJECTIVES:**

The students will understand the basic concepts of

1. The Genome
2. Sequencing of genome
3. Protein functions.

**CONTENTS**

**UNIT-I**

Genome mapping, Genome sequencing, Genome sequence assembly: Base calling and assembly programs, Genome annotation: Gene ontology, Automated genome annotation, Annotation of hypothetical proteins and Genome economy.

**UNIT-II**

Microarray based approaches: Oligonucleotide design, Data collection, Image processing, Data transformation and normalization, Statistical analysis to identify differentially expressed genes and Microarray data classification. Comparison of SAGE and DNA Microarrays.

**UNIT-III**

Technology of protein expression analysis: 2D-PAGE, Mass spectrometry protein identification, protein identification through database searching, Differential in-gel electrophoresis and Protein Microarrays.

**UNIT-IV**

Experimental determination of protein-protein interaction, Prediction of protein-protein interactions: prediction interactions based on domain fusion, predicting interactions based on gene neighbors, predicting interactions based on sequence homology.

## UNIT-V

Medical proteomics-disease diagnosis: Biomarkers, Biomarker discovery using 2DGE and mass spectrometry and Biomarker discovery and pattern profiling using protein chips. Pharmaceutical proteomics-drug development: The role of proteomics in target identification, Proteomics and target validation, Proteomics in the development of lead compounds and Proteomics and clinical development.

### TEXT BOOKS:

1. *Xiong, J.* 2006. **Essential Bioinformatics.** Cambridge University Press, Cambridge, UK.
2. *Soundararaja, S.* 2002. **Introduction to Bioinformatics.** 1<sup>st</sup> edition. Himalaya Publishing House.

### REFERENCES BOOKS

1. *Dan E Krane and Michael L. Raymer.* 2003. **Fundamental concepts of Bioinformatics.** 1<sup>st</sup> edition. Benjamin Cummings.
2. *Gladis Helen Hepsyba,S., and Hemalatha, C .R.* 2009. **Basic Bioinformatics,** 1<sup>st</sup> edition. MJP publisher.

15PBT23C	GENETIC ENGINEERING	SEMESTER - II
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**Total Credits: 4**  
**5 Hours / Week**

### **OBJECTIVES:**

The student will understand the

1. Manipulation of genes
2. Transfer techniques
3. Expression systems

### **CONTENTS**

#### **UNIT-I**

Restriction enzyme, DNA Polymerases, RNA polymerase, Taq polymerase, DNA Ligase, methylase, polynucleotide kinase, alkaline phosphatase, reverse transcriptase, DNase I, S<sub>1</sub>nuclease, RNase H, terminal deoxynucleotidyl transferase.

#### **UNIT-II**

Cloning in *E.coli*, cloning in organisms other than *E.coli*, Plasmid Vectors, Bacteriophage Vectors, phagemids, Cosmids, yeast vectors, Plant and animal vectors, Specialized vectors - expression & fusion vectors.

#### **UNIT-III**

Genomic Library; cDNA library- types & screening, Restriction mapping of DNA fragments and map construction, DNA sequencing, Nucleic Acid Blotting Techniques, Gel retardation, RFLP & RAPD.

#### **UNIT-IV**

Site - directed mutagenesis, detection of mutation by SSCP and heteroduplex analysis, Protein Engineering: processing and stabilization of recombinant proteins. Applications of protein Engineering.

#### **UNIT-V**

Gene therapy: Different types and applications, salient features of Human Genome project. PCR: Types & applications, patenting of life forms, ethical issues in Genetic Engineering.

**TEXT BOOKS:**

1. *Glick, R. and Pasternak Jack, J.* 1996. **Molecular Biotechnology.** 1<sup>st</sup> edition. Panima Publishing Corporation.
2. *Brown, T. A.* 1998. **Introduction to gene cloning.** 3<sup>rd</sup> edition. Stanley Thomas Publishing Ltd.

**REFERENCES BOOKS:**

1. *Winnacker, Ernst, L.* 2003. **From genes to clones.** 2<sup>nd</sup> edition. Panima publishing corporation.
2. *James D. Watson,* 2001. **Recombinant DNA technology.** 2<sup>nd</sup> edition. WH Freeman and company.



<b>15PBT23D</b>	<b>BIOPROCESS TECHNOLOGY</b>	<b>SEMESTER - II</b>
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**Total Credits: 4**  
**5 Hours / Week**

### **OBJECTIVES:**

The student will be able to

1. Describe the selection, preparation, and operation of bioreactors and instrumentation.
2. Evaluate the results of hands-on upstream processing experiments.
3. Examine cell culture and fermentation technology through applied biochemical engineering.

### **CONTENTS**

#### **UNIT-I**

Fermentation - a Historical perspective. Biotechnology and bioprocess engineering, Primary and Secondary metabolites of industrial importance, Techniques involved in screening / detection of industrially important microorganisms.

#### **UNIT-II**

Bioreactor design, parts and their functions, Alternative vessel designs - CSTR, Tower, Airlift, Loop jet, Bubble Column, Packed bed. Sterilization. Thermal death kinetics. Design of continuous sterilization process, Fibrous filters.

#### **UNIT-III**

Microbiology of Industrial fermentation, Fermentation kinetics, Rheological properties of the medium, Theory of mixing. Oxygen transfer rate, Oxygen transfer coefficient and correlation. Mass transfer, Biological heat transfer and heat transfer coefficient.

#### **UNIT-IV**

Different types of instrumentation, common measurement and control systems, Additional sensors, Feedback control, PID control, Computers in Bioprocess control systems, Biosensors in bioprocess monitoring and control.

## UNIT-V

Downstream processing, Removal of microbial cells, cell disruption - enzymatic, chemical and physical methods; purification of fermentation products - precipitation methods, membrane process, Centrifugation - Ultracentrifugation; Chromatography - Ion exchange and gel permeation chromatography, HPLC; crystallization, drying, lyophilisation, packaging and quality assurance.

### TEXTBOOKS:

1. Peter. F. Stanbury, Allan Whitaker and Stephen. J. Hall. 2007. **Principles of Fermentation Technology**. 2<sup>nd</sup> edition. Elsevier Science Ltd.
2. Wulf Crueger and Anneliese Crueger. 2005. **Biotechnology- A Textbook of Industrial Microbiology**. 2<sup>nd</sup> edition. Panima Publishing Corporation.

### REFERENCES:

1. Michael L. Shuler and Fikret Kargi. 2001. **Bioprocess Engineering- Basic concepts**. 2<sup>nd</sup> edition. Prentice Hall International services.
2. El-Mansi, E.M.T, Bryce, C. F., A, Arnold L. Demain, and Allman, A.R. 2011. **Fermentation Microbiology and Biotechnology**. 3<sup>rd</sup> edition. CRC Press.

15PBT23P	CORE PRACTICAL- II	SEMESTER - II
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Total Credits: 4  
5 Hours / Week

1. Blood smear preparation for the identification of Blood cells
2. Total RBC and WBC count
3. Radial Immunodiffusion
4. Ouchterlony double diffusion
5. Precipitin ring test
6. Immunoelectrophoresis
7. Rocket immuno electrophoresis
8. SDS-PAGE and Immuno blotting
9. Extraction of genomic DNA from plant
10. Extraction of genomic DNA from bacteria
11. Extraction of genomic DNA from animal tissue
12. Plasmid DNA extraction
13. Restriction digestion
14. Ligation
15. Wine making
16. Production and assay of extra cellular enzyme - Protease

**REFERENCE BOOKS:**

1. *Olivier Cochet, Jean-Luc Teillaud, Catherine Sautes Wiley.* 1998.  
**Immunological Techniques Made Easy.** 1<sup>st</sup> edition. John Wiley & Son Ltd.
2. *S. Ignacimuthu.* 2001. **Methods in Biotechnology.** 1<sup>st</sup> edition.  
Phoenix publishing house.

<b>15PBT2EA</b>	<b>ELECTIVE- II: BIOETHICS, BIOSAFETY AND IPR</b>	<b>SEMESTER - II</b>
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**Total Credits: 4  
5 Hours / Week**

**OBJECTIVES:**

1. To study the good laboratory procedure and practices, standard operating procedures for biotechnology research
2. To learn about the legal and institutional framework for biosafety

**CONTENTS**

**UNIT-I**

Introduction to ethics/bioethics - framework for ethical decision making; biotechnology and ethics -benefits and risks of genetic engineering - ethical aspects of genetic testing - ethical aspects relating to use of genetic information - genetic engineering and biowarfare.

**UNIT-II**

Ethical implications of cloning: Reproductive cloning, therapeutic cloning; Ethical, legal and socioeconomic aspects of gene therapy, germ line, somatic, embryonic and adult stem cell research-GM crops and GMO's - biotechnology and biopiracy - ELSI of human genome project.

**UNIT-III**

Introduction to biosafety - biosafety issues in biotechnology - risk assessment and risk Management - safety protocols: risk groups - biosafety levels - biosafety guidelines and regulations (National and International) - operation of biosafety guidelines and regulations - types of biosafety containment.

**UNIT-IV**

Introduction to intellectual property and intellectual property rights - types: patents, copy rights, Trade marks, design rights, geographical indications - importance of IPR - world intellectual Property rights organization (WIPO).

## UNIT-V

Patent – Patenting life – legal protection of biotechnological Inventions – Patenting in India: Indian patent act.

### TEXTBOOKS:

1. *Deepa Goel*. 2013. **IPR Bio safety and Bioethics**. 1<sup>st</sup> edition. Pearson Education.
2. *Sateesh, M.K.* 2008. **Bioethics and Biosafety**. 1<sup>st</sup> Edition. I K International Publishing House.

### REFERENCE BOOKS:

1. *Srinivasan, K. and Awasthi, H.K.* 1997. **Law of Patents**. 1<sup>st</sup> edition. Jain Book Agency.
2. *Thomas H. Murray and Maxwell J. Mehlman.* 2005. **Encyclopedia of Ethical, Legal and Policy issues in Biotechnology**. 1<sup>st</sup> edition. Wiley-Interscience.

<b>15PBT2EB</b>	<b>ELECTIVE - II: PROTEIN ENGINEERING</b>	<b>SEMESTER - II</b>
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**Total Credits: 4  
5 Hours / Week**

**OBJECTIVES:**

1. To study the Structure and Functions of Protein
2. To learn about the characteristics of Protein

**CONTENTS**

**UNIT-I**

Covalent, Ionic, Hydrogen, Coordinate, hydrophobic and Vander walls interactions in protein structure. Interaction with electromagnetic radiation (radio, micro, infrared, visible, ultraviolet, X-ray).

**UNIT-II**

Amino acids and their molecular properties, Chemical reactivity in relation to post-translational modification and peptide synthesis. Peptide mapping, peptide sequencing - automated Edman method & mass-spec.

**UNIT-III**

Protein structure: Primary and Secondary structure, methods to determine Super-secondary structure. Tertiary structure - Domains, folding, denaturation and renaturation, overview of methods to determine 3D structures, Quaternary structure: Modular nature, formation of complexes.

**UNIT-IV**

DNA-binding proteins: prokaryotic transcription factors, Helix-turn-Helix motif in DNA binding, Helix loop Helix in DNA binding, Trp repressor, Eukaryotic transcription factors, Zn fingers, Leucine zippers.

**UNIT-V**

Membrane proteins: General characteristics, Trans membrane segments, prediction, bacteriorhodopsin and Photosynthetic reaction center.

**TEXTBOOKS:**

1. *Voet, D. and Voet, G.* 2001. **Biochemistry**, 3<sup>rd</sup> edition. John Wiley and Sons.
2. *Moody, P.C.E. and Wilkinson, A.J.* 1990. **Protein Engineering**. 1<sup>st</sup> edition. IRL Press.

**REFERENCE BOOKS:**

1. *Branden, C. and Tooze, J.* 1999. **Introduction to Protein Structure**. 2<sup>nd</sup> edition. Garland Publishers.
2. *Creighton, T.E.* 1993. **Proteins**. 2<sup>nd</sup> edition. Freeman WH.

15PBT33A	MOLECULAR DIAGNOSTICS	SEMESTER - III
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Total Credits: 4  
5 Hours / Week

**OBJECTIVES:**

1. To study about the types of PCR and its applications in diagnosis
2. To learn about the human genome project

**CONTENTS**

**UNIT-I**

Nucleic acid structure, replication, transcription, translation; Nucleic acid extraction. Electrophoresis, Blotting Techniques, Nucleic acid probe preparation, DNA sequencing.

**UNIT -II**

DNA amplification techniques and applications including reverse transcriptase (RT)-PCR, *in situ* PCR. PCR, sample preparation, experimental design, primers, controls, product detection.

**UNIT -III**

Ligase chain reaction, nucleic acid sequence-based amplification, branched DNA detection. RT-PCR, relative RT-PCR, competitive RT-PCR. RACE, RNA fingerprinting.

**UNIT -IV**

PCR-based mutation detection, single-stranded conformational polymorphism analysis, heteroduplex analysis, denaturing gradient gel electrophoresis.

**UNIT -V**

*In situ* nucleic acid hybridization and amplification: ISH, FISH, ISA. Applications and limitations. DNA chips, gene therapy; applications in diagnosis of genetic disorders, human genome project, ethical considerations.



**TEXT BOOKS:**

1. *Freifelder, D. and Malacinski, G. M.* 1996. **Essential of Molecular Biology**, 2<sup>nd</sup> edition. Panima Publishing Co., New Delhi.
2. *Brown, T. A.* 2010. **Gene Cloning and DNA Analysis: An Introduction**, 6<sup>th</sup> edition. Wiley.

**REFERENCE BOOKS:**

1. *Primrose. S.B, Twyman, R and Old, B.* 2001, **Principles of Gene Manipulation**, 6<sup>th</sup> edition, Wiley-Blackwell.
2. *Walker, M.R and Rapley, R.*1997. **Route maps in Gene Technology**.1<sup>st</sup> edition, Blackwell science Ltd, USA.

15PBT33B	PLANT BIOTECHNOLOGY	SEMESTER - III
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Total Credits: 4  
5 Hours / Week

### OBJECTIVES:

This subject will be able to understand the

1. Various *in vitro* culture techniques
2. Preservation of plant cells
3. Gene transferring mechanisms

### CONTENTS

#### UNIT-I

Tissues culture media, Micropropagation: Callus and suspension culture, somaclonal variation, somatic embryogenesis: Embryo culture, protoplast isolation and somatic hybridization; Haploid plants, Artificial seeds and hardening.

#### UNIT-II

Genome organization: Nuclear genome, chloroplast genome, mitochondrial genome, CMS, Protein targeting to chloroplast and mitochondria, Heat shock proteins, seed storage proteins

#### UNIT-III

Dominant and Co dominant markers - RFLP Maps, RAPD markers, microsatellites, AFLP, SCAR, STS, SSCP, Uses of marker genes - molecular marker assisted selection.

#### UNIT-IV

Features of Ti and Ri plasmids, uses of Ti and Ri as vectors, binary vectors, use of 35S and other promoters, viral vectors, use of reporter genes, Transgenic biology - methods of nuclear transformation - physical, chemical and biological gene transfer methods in plants.

#### UNIT-V

Engineering of plants for herbicide resistance, insect resistance, virus resistance, disease resistance, antifungal proteins, nematode resistance, abiotic stress, long shelf life of fruits and flowers. Green house and green - home technology.

**TEXTBOOKS:**

1. *Singh, B.D.* 2006. **Plant Biotechnology** . 1<sup>st</sup> edition. Kalyani Publishers.
2. *Chawla, H. S.* 2013. **Introduction to Plant Biotechnology**. 3<sup>rd</sup> edition. Oxford & IBH publishing company.

**REFERENCE BOOKS:**

1. *Grierson, D.* and *Covey, S.V.* 1988. **Plant Molecular Biology**. 2<sup>nd</sup> edition. Blackie Publishers.
2. *Bhojwan, S. S.* 1996. **Plant tissue culture - Theory and Practice**. 1<sup>st</sup> edition. Elsevier Publishers.

15PBT33C	ANIMAL BIOTECHNOLOGY	SEMESTER - III
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**Total Credits: 4**  
**5 Hours / Week**

**OBJECTIVES:**

The students will be able to understand the

1. Various *in vitro* culture techniques
2. Preservation of animal cells
3. Gene transferring mechanisms

**CONTENTS**

**UNIT-I**

Introduction to Animal cell culture, preparation of culture media: Role of carbon dioxide, serum, growth factors in cell culture, serum and protein free defined media.

**UNIT-II**

Types of animal cell culture - Primary cell culture: organ culture; Primary explants culture; cell lines. Cell separation, cryo preservation. Biology of cells in culture; tissue typing: measurement of cell growth and death-cytotoxicity assays.

**UNIT-III**

Gene transfer in animal cell culture, gene targeting, silencing and knock-out, production of native and recombinant proteins in animal cell, Applications of animal cell culture - Hybridoma technology and its applications. Tissue engineering.

**UNIT-IV**

Gametogenesis; spermatogenesis and oogenesis; Fertilization in animals, Blastulation, gastrulation, early embryonic development - fate map. Conventional methods of improvement of animal live stock: artificial insemination, In vitro fertilization, Embryo culture, Embryo sexing, splitting and cloning.

**UNIT-V**

Production of transgenic animals - uses of transgenic animals, cloning of animals, aquaculture biotechnology of silk worm -life cycle of silk worm for

the commercial production of silk, baculovirus in Bio control & foreign gene expression; improving qualities of silk, integrated pest management.

**TEXT BOOKS:**

1. *John R. Masters.* 2000. **Animal cell culture.** 3<sup>rd</sup> edition. Oxford University Press.
2. *Ranga,M.M.* 2007. **Animal Biotechnology.** 3<sup>rd</sup> edition. Agrobios India

**REFERENCES:**

1. *Freshney, R.I.*1996. **Animal cell culture: A practical approach.** 2<sup>nd</sup> edition. Oxford University Press
2. *Spier, R.E.* 2010. **Animal Cell Biotechnology.** 1<sup>st</sup> edition. Elsevier Publishers.

<b>15PBT33D</b>	<b>ENVIRONMENTAL BIOTECHNOLOGY</b>	<b>SEMESTER - III</b>
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**Total Credits: 4  
5 Hours / Week**

**OBJECTIVES:**

This subject will provide the information about the

1. Basic vocabulary of environmental biology
2. Hazards of industrial pollutants on environment
3. Effect of pollution on biodiversity

**CONTENTS**

**UNIT-I**

Interactions between environment and biota; Concept of habitat and ecological niches; Limiting factor; Energy flow, food chain, food web and trophic levels; Ecological pyramids and recycling, biotic community-concept, structure, dominance, fluctuation and succession; N.P.C and S cycles in nature.

**UNIT-II**

Stability and complexity of ecosystems; Speciation and extinctions; environmental impact assessment; Principles of conservation; Conservation strategies; sustainable development. Global environmental problems: ozone depletion, UV-B, green house effect and acid rain.

**UNIT-III**

Types of pollution, Methods for the measurement of pollution; Methodology of environmental management and its limitations. Need for water management. Distribution and impact of environmental factors on the aquatic biota.

**UNIT-IV**

Waste water collection, Physico-chemical properties of water, physical, chemical and biological treatment processes. Anaerobic digestion, anaerobic filters, Up flow anaerobic sludge blanket reactors. Treatment schemes for waste waters of dairy, distillery, sugar, antibiotic industries. Management of estuarine, coastal water systems and man-made reservoirs.

**UNIT-V**

Xenobiotics - Ecological considerations, decay behaviour and degradative plasmids, hydrocarbons, substituted hydrocarbons, oil pollution, surfactants, pesticides. Biopesticides in integrated pest management. Bioremediation of contaminated soils and wastelands. Solid waste: Sources and management (composting, vermiculture and methane production).

**TEXT BOOKS:**

1. *Agarwal, K.M, Sikdar, P.K & Deb, C.S.* 2002. **A Text Book of Environment.** MacMillan India Ltd.
2. *Varma, P.S.* 1998. **Concept of Ecology.** 1<sup>st</sup> edition. Chand & Co Ltd.

**REFERENCE BOOKS:**

1. *Dash, M.C.* 1998. **Fundamentals of Ecology.** 2<sup>nd</sup> edition. Tata McGraw Hill.
2. *Alan Scragg.* 2007. **Environmental biotechnology.** 2<sup>nd</sup> edition. Oxford university press.

<b>15PBT33P</b>	<b>CORE PRACTICAL - III</b>	<b>SEMESTER - III</b>
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**Total Credits: 4**  
**5 Hours / Week**

1. *In vitro* Seed Germination
2. Micropropagation
3. Meristem culture
4. Callus induction
5. Artificial Seed production
6. Suspension cultures
7. Embryo culture
8. Protoplast Isolation
9. Preparation of primary cell culture
10. Trypsinizing and subculturing cells
11. Determining cell number and viability with a haemocytometer and trypan blue staining
12. Water Quality analysis-Colour, pH, Acidity
13. MPN Test
14. Total hardness by EDTA titrimetric method
15. Estimation of Total alkalinity, carbonate and bicarbonate
16. Determination of Chemical oxygen demand
17. Screening for dye decolourisation by bacteria/ fungi

**REFERENCE BOOKS:**

1. Sant Saran Bhojwani, Razdan, M. K. 1996. **Plant tissue culture: theory and practice**. 1<sup>st</sup> edition. Elsevier science.
2. Freshney, R. I. 2010. **Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications**. 6<sup>th</sup> edition. Wiley Blackwell.
3. Choudhary, S. S, Choudhary, P. and Choudhary, S.K. 2005. **Laboratory guide in biosciences**. 2<sup>nd</sup> edition. Kalyani publishers.



<b>15PBT3EA</b>	<b>ELECTIVE - III: STEM CELL BIOLOGY AND TISSUE ENGINEERING</b>	<b>SEMESTER - III</b>
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**Total Credits: 4  
5 Hours / Week**

**OBJECTIVES:**

1. To study the types of Stem cells
2. To learn about the applications of Tissue Engineering

**CONTENTS**

**UNIT-I**

Introduction to Stem Cells - Definition, Classification, Characteristics  
Differentiation and dedifferentiation, Stem cell niche, stem cell Vs cells;  
Basic culture procedures - isolation, culture methods, identification, stem  
cell markers, feeder layer; Instrumentations in stem cell biology.

**UNIT-II**

Different kinds of stem cells - Adult Stem cells, Embryonic stem cells,  
Haematopoietic stem cells, Neural stem cells, muscle and cardiac stem  
cells, Umbilical cord blood stem cells, cancer stem cells, Mesenchymal  
stem cells, Induced pluripotent Stem cells.

**UNIT-III**

Therapeutic applications - stem cells and neurodegenerative disorders,  
stem cells and diabetes, stem cells and cardiac disorders, regeneration of  
epidermis, Stem cell banking, Stem cell research - World federal funding  
for stem cell research; Public view and ethical approaches on stem cells.

**UNIT-IV**

Principles of Tissue Engineering - History and scope, Basics of Tissue  
Engineering, Tissue Engineering triangle, Cell-ECM interaction, wound  
healing mechanism, Tissue Engineering Bioreactors, Models of Tissue  
Engineering and Biomaterials in Tissue Engineering.

**UNIT-V**

Bioartificial organs - source of cells, choosing the right scaffold material,  
mode of transplantation. Epidermal Tissue engineering, Bladder  
reconstruction, Skin equivalents, Liver reconstruction, Bone regeneration  
through tissue engineering, Tissue Engineering and future perspectives.

**TEXT BOOKS:**

1. *Robert Lanza*. 2013. **Principles of Tissue Engineering**. 4<sup>th</sup> edition. Academic Press.
2. *Christopher Thomas Scott*. 2005. **Stem cell now**. 1<sup>st</sup> edition. Pearson Education.

**REFERENCES:**

1. *Song Li, Nicolas L'Heureux, Jennifer Elisseeff*. 2011. **Stem Cell and Tissue Engineering**. 1<sup>st</sup> edition. World Scientific Publishers.
2. *Robert Lanza, John Gearhart, Brigid Hogan*. 2006. **Essentials of Stem Cell Biology**. 2<sup>nd</sup> edition. Macmillan Publishing Solutions.

<b>15PBT3EB</b>	<b>ELECTIVE- III: PRINCIPLES OF CLINICAL TRAILS</b>	<b>SEMESTER - III</b>
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**Total Credits: 4**  
**5 Hours / Week**

**OBJECTIVES:**

1. To learn about the regulations in Clinical trials.
2. To study about the various guidelines

**CONTENTS**

**UNIT-I**

Introduction to Pharmaceutical Industry, Preclinical studies - Preclinical technology, Chemistry manufacturing and controls / Pharmaceutics Pharmacology/Toxicology. Phase I, Phase II A and B, Phase III A and B, Phase IV and Types of Post marketing, surveillances.

**UNIT-II**

History of GCP, FDA Regulations for Clinical Trials, ICH Guidelines for Good Clinical Practice , FDA Guidelines and Information Sheets , FDA Compliance Program Guidance Manuals, NIH Regulated Research, FDA Bioresearch Monitoring Program (BIMO), Good Clinical Practice (GCP).

**UNIT-III**

Ethical Guidelines for Biomedical Research in Human Subjects, Central Ethics committee on Human Research (CECHR), ICMR, 2000, Clinical research regulation DCGI.

**UNIT-IV**

GCP Guidelines, Central Drugs Standardization and Control Organization, Government of India, Schedule Y.

**UNIT-V**

Sponsor's responsibilities, Essential documentation and Investigator's Brochure, Protocol design, CRF design, Informed Consent Documents - Subject Information Sheet and Informed Consent Form, Ethics Committee Approvals.

**TEXT BOOKS:**

1. *Allan Hackshaw*. 2009. **A Concise Guide to Clinical Trials**. 1<sup>st</sup> edition. Wiley Publishers.
2. *Richard Chin* and *Bruce Y. Lee*. 2008. **Principles and Practice of Clinical Trial Medicine**. 1<sup>st</sup> edition. Academic Press.

**REFERENCE BOOKS:**

1. *Sandy Weinberg*. 2009. **Guide Book for Drug Regulatory Submissions**. 1<sup>st</sup> edition. *John Wiley & sons* .
2. *Haynes, R.B., Sackett, D.L., Guyatt, G.H.,and Tugwell, P.* 2005.**Clinical Epidemiology: How to Do Clinical Practice Research**. 3<sup>rd</sup> edition. Lippincott- Williams and Wilkins.

<b>15PBT43A</b>	<b>RESEARCH METHODOLOGY</b>	<b>SEMESTER - IV</b>
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**Total Credits: 4**  
**5 Hours / Week**

### **OBJECTIVES:**

The student will understand the

1. Basic concepts of research and its methodologies
2. Identify appropriate research topics
3. Basic theory, philosophy and application of statistics

### **CONTENTS**

#### **UNIT-I**

Research/Experimental design, Literature collection, Literature citation, Research report: components, Format of thesis and dissertation, Manuscript/research article, Review monographs, Bibliography and Reference, Significance of research.

#### **UNIT-II**

Reporting the results of research in conference - Oral presentation - Poster presentation - Written reports - Planning and preparing a thesis - Proof correction.

#### **UNIT-III**

Standard of research journals impact factor - citation index. Information retrieval - access to archives and databases, search engines - Google, Pubmed - national informatics center network services. Online database library.

#### **UNIT-IV**

Sampling methods: random sampling - types of variables: qualitative and quantitative variables - continuous and discontinuous variables - scaling method - mean - standard deviation - standard error - coefficient of variation: elucidation with model sums.

#### **UNIT-V**

Chi square test, students t test, ANOVA with interpretation of data - introduction to ANOVA - statistical tables and their uses - significance

tests and fixing levels of significance. Uses of statistical software like SPSS.

**TEXT BOOKS:**

1. *Kothari, C. K.* 2004. **Research Methodology- Methods and Techniques.** 2<sup>nd</sup> edition. New Age International.
2. *Motulsky, H.* 1995. **Intuitive Biostatistics.** 1<sup>st</sup> edition. Oxford University press.

**REFERENCE BOOKS:**

1. *Lee, E. S. and Forthofer, R. N.,* 2006. **Introduction to Biostatistics: A guide to design, analysis and discovery.** 2<sup>nd</sup> edition. Academic press.
2. *Krishnaswamy, K. N., Sivakumar, Appa Iyer and Mathiranjani, M.* 2006. **Management Research Methodology, Integration of Principles, Methods and Techniques.** 1<sup>st</sup> edition. Pearson Education.

<b>15PBT4EA</b>	<b>ELECTIVE- IV : PHARMACEUTICAL BIOTECHNOLOGY</b>	<b>SEMESTER-IV</b>
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**Total Credits: 4  
5 Hours / Week**

### **OBJECTIVES:**

The students will be able to understand the

1. Evaluate different pharmaceutical parameters of current biotechnology products.
2. Determine parameters related to stability and formulation of biotechnology products
3. Discuss quality control procedures related to biotechnology products.

### **CONTENTS**

#### **UNIT-I**

History of Pharmaceutical Industry, Drugs discovery, development phases and Drug manufacturing process. Drugs and cosmetics ACT and regulatory aspects. Generics and its advantages. Biogenerics and biosimilars. Protein based biopharmaceuticals.

#### **UNIT-II**

Pharmacodynamics of protein therapeutics; Chemical modification of proteins therapeutics; Immuno suppressive antibody therapy; Pharmacogenomics, Molecular modification of lead compounds; Assay system models (e.g., Knock-out Mice). Antisense technology as cell based therapeutics.

#### **UNIT-III**

Drugs derived from plants: antitumor agent - Etoposide, Colchicine, Taxol, Vinblastine, Vincristine. Cardiotoxic - Convallatoxin, Acetyldigoxin, Adoniside. Antiinflammatory - Aescin, Bromelain. Choleric - Curcumin, Biopharmaceuticals Expressed in plant alternative expression systems.

#### UNIT-IV

DNA Vaccine Construction and Immunology. Delivery of DNA Vaccines. Peptide vaccine, Gene Pharming, Cytokines as biopharmaceuticals, Rituximab, therapeutic enzymes.

#### UNIT-V

Erythropoietin (EPO), Colony stimulating Factors (CSFs), Human Growth Hormone (hGH), Insulin, Hepatitis B Vaccine, Factor VIII (FVIII), Interferon (IFN).

#### TEXT BOOKS:

1. *Oliver Kayser and Rainer H. Müller.* 2005. **Pharmaceutical Biotechnology: Drug Discovery and Clinical Applications.** 1<sup>st</sup> edition. Wiley Publishers.
2. *Jay P. Rho. and Stan G. Louie.* 2003. **Hand book of Pharmaceutical Biotechnology.** 1<sup>st</sup> edition. CRC Press.

#### REFERENCE BOOKS:

1. *Goodman and Gilman.* 2006. **The Pharmacological Basis of Therapeutics.** 11<sup>th</sup> edition. Mc Graw Hill Medical Publishing Division.
2. *Heinrich Klefenz.* 2002. **Industrial Pharmaceutical Biotechnology.** 1<sup>st</sup> edition. WILEY-VCH Publication.



<b>15PBT4EB</b>	<b>ELECTIVE- IV : FOOD BIOTECHNOLOGY</b>	<b>SEMESTER-IV</b>
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**Total Credits: 4  
5 Hours / Week**

**OBJECTIVES:**

1. To learn about the role of foods in Biotechnology
2. To study about the production of different foods and their properties

**CONTENTS**

**UNIT-I**

Introduction to Food Biotechnology; development and impact of biotechnology on food and dairy industry. Microbes in food industry.

**UNIT-II**

Microbial rennet and recombinant chymosin, exogenous free and microencapsulated enzymes, immobilized enzymes- their application in accelerated ripening of cheese; enzymatically modified cheeses (EMC) their utilization in various food formulations.

**UNIT-III**

Technological innovations in the development of functional dairy foods with improved nutritional therapeutic and pro-biotic attributes; physiologically active bio-peptides/ Nutraceuticals. Production of bio-yoghurt, pro-biotic cheese and fermented Milks; bifidus factors in infant food formulations.

**UNIT-IV**

Protein hydrolysates- production, their physicochemical, therapeutic properties, de-bittering and application in food formulations; Enzymatic hydrolysis of lactose for preparation of whey and UF-permeate beverages.

**UNIT-V**

Microbial polysaccharides - their properties and applications in foods, production of alcoholic beverages and industrial products from starch; whey and other by-products; bio-sweeteners-types properties and their applications in dairy and food industry.

**TEXT BOOKS:**

1. *Lee Byong, H.V.* 1996. **Fundamentals of Food Biotechnology**. 1<sup>st</sup> edition. C H Publishers.
2. *Roger, A.* 1989. **Food Biotechnology**, 1<sup>st</sup> edition. Elsevier Applied Sci. Pub.

**REFERENCE BOOKS:**

1. *Goldberg Israel.* 1994. **Functional Foods**. 1<sup>st</sup> edition. Chapman & Hall Publishers.
2. *Anthony Pometto, Kalidas Shetty, Gopinadhan Paliyath, Robert E. Levin.* 2005. **Food Biotechnology**. 2<sup>nd</sup> edition. CRC Publication.

15PBT33A	MOLECULAR DIAGNOSTICS	SEMESTER - III
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Total Credits: 4  
5 Hours / Week

**OBJECTIVES:**

1. To study about the types of PCR and its applications in diagnosis
2. To learn about the human genome project

**CONTENTS**

**UNIT- I**

Historical introduction. Infection - Mode of transmission in infections, factors predisposing to microbial pathogenicity, types of infectious diseases. Sample collection - Method of collection, transport and processing of samples. Interpretation of results. nosocomial infections. Host - Parasite relationships.

**UNIT -II**

Pathogenicity and diagnosis of infection caused by *Streptococcus*, *Coliforms*, *Salmonella*, *Shigella*, *Vibrio* and *Mycobacterium*. Diagnosis of fungal infections. Major fungal diseases : Dermatophytoses, Candidiasis and Aspergillosis.

**UNIT -III**

Diagnosis of DNA and RNA Viruses. Pox Viruses, Adenoviruses and Hepatitis, Retro Viruses. Genetic disorders : Sickle Cell Anaemia, Duchenne muscular dystrophy, Retinoblastoma, Cystic Fibrosis and Sex Linked inherited disorders.

**UNIT -IV**

Nucleic acid, amplification methods and types of PCR : Reverse Transcriptase - PCR, Real-Time PCR, Inverse PCR, Multiplex PCR, Nested PCR, Alu-PCR, Hot-start, In situ PCR, Long-PCR, PCR-ELISA, Arbitrarily primed PCR, Ligase Chain Reaction. Applications of PCR - PCR based microbial typing: Eubacterial identification based on 16S rRNA sequences.

**UNIT -V**

Amplified Ribosomal DNA Restriction analysis (ARDRA) – Culture independent analysis of bacteria – DGGE and TRFLP. Molecular diagnosis of fungal pathogens based on 18S rRNA sequences – Detection of viral pathogens through PCR. PCR in forensic science – AmpFLP, STR, Multiplex PCR – Determination of Paternity – Human identification and sex determination.

**REFERENCE BOOKS:**

1. *David E Bruns, Edward R. Ashwood, and Carl A. Burtis.* 2007. **Fundamentals of Molecular Diagnostics.** 1<sup>st</sup> Edition. Saunders / Elsevier Group.
2. *Richard A Mcpherson and Matthew R Pincus.* 2007. **Henry's Clinical Diagnosis and Management by Laboratory Methods.** 22<sup>nd</sup> edition. Saunders Elsevier.
3. *Lele Buckingham and Maribeth L. Flaws.* 2007. **Molecular Diagnostics : Fundamentals, Methods & Clinical applications.** 2<sup>nd</sup> Edition. F.A. Davis Company.
4. *W.B. Coleman.* 2006. **Molecular Diagnostics for the Clinical laboratorian.** 2<sup>nd</sup> Edition. Humana Press.

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*13.4.2016*