

Annexure – 19

PERIYAR UNIVERSITY

SALEM – 636 011



PERIYAR INSTITUTE OF DISTANCE EDUCATION [PRIDE]

NON- SEMESTER PATTERN [PRIDE]

M.Sc., BIOTECHNOLOGY

REGULATIONS AND SYLLABUS

[Candidates admitted from 2007-2008 onwards]

PERIYAR UNIVERSITY, SALEM –636 011

PERIYAR INSTITUTE OF DISTANCE EDUCATION [PRIDE]

M.Sc., BIOTECHNOLOGY

REGULATIONS

1. CONDITION FOR ADMISSION

A candidate who has passed a Bachelor degree in Science with Biotechnology / Botany / Zoology / Biology / Microbiology / Microbial Gene technology / Bioinstrumentation / Bioinformatics / Biochemistry / Chemistry / Agriculture / Marine Biology / Home Science / Farm Science / Nutrition and Dietetics / Integrated Biology / Plant Science / Animal Science / Fisheries Science / Aquaculture / Mathematics with Physics, Chemistry as Ancillary / Medical Lab Technology / MBBS / BDS / B. Pharm / BSMS of this University or any of the above degree of any other University accepted by syndicates as equivalent thereto, subject to such conditions as may prescribed therefore shall be permitted to appear and qualify for the M. Sc., Biotechnology Degree Examination of this University after a course of study of two academic years.

2. DURATION OF THE COURSE

The course for the degree of Master of Biotechnology shall consist of two academic years.

3. COURSE OF STUDY

The course of study shall comprise instruction in the following subjects according to the syllabus and books prescribed from time to time.

S.No:	PAPER	TITLE OF THE PAPER
1st - YEAR		
1	Paper I	Cell Biology
2	Paper II	Biomolecules
3	Paper III	Microbial Physiology and Genetics
4	Paper IV	Molecular Biology
5	Paper V	Plant Biotechnology
6	Paper VI	Animal Biotechnology
7	Paper VII	Research Methodology in Biotechnology
8	Practical 1	Lab in Cell Biology, Biomolecules, Microbial Physiology & Genetics and Molecular Biology
9	Practical 2	Lab in Plant and Animal Biotechnology
2nd - YEAR		
10	Paper VIII	Genetic Engineering
11	Paper IX	Immunology and Immunotechnology
12	Paper X	Enzymology and Enzyme Technology
13	Paper XI	Bioprocess Engineering and Technology
14	Paper XII	Environmental Biotechnology
15	Paper XIII	Food and Pharmaceutical Biotechnology
16	Paper XIV	Bioinformatics, IPR and Bioethics
17	Practical 3	Lab in Genetic Engineering and Immunology & Immunotechnology,
18	Practical 4	Lab in Enzymology & Enzyme Technology, Bioprocess Engineering and Technology
19	Project	Dissertation / Project Work & Viva – Voce [Project report (150) + Viva - Voce (50)]

4. EXAMINATIONS

The theory examination shall be three hours duration to each paper at the end of year. The candidate failing in any subject(s) will be permitted to appear for each failed subject(s) in the subsequent examinations.

The practical examinations for PG course should be conducted at the end of the year. At the end of the II year Viva- Voce will be conducted and on basis of the Dissertation /Project work submitted by the student. One internal and one external examiner will conduct the Viva voce jointly.

5. SCHEME OF EXAMINATIONS

S.No:	PAPER	TITLE OF THE PAPER	Exam. Duration	MARKS
1st YEAR				
1	Paper I	Cell Biology	3	100
2	Paper II	Biomolecules	3	100
3	Paper III	Microbial Physiology and Genetics	3	100
4	Paper IV	Molecular Biology	3	100
5	Paper V	Plant Biotechnology	3	100
6	Paper VI	Animal Biotechnology	3	100
7	Paper VII	Research Methodology in Biotechnology	3	100
8	Practical 1	Lab in Cell Biology, Biomolecules, Microbial Physiology & Genetics and Molecular Biology	6	100
9	Practical 2	Lab in Plant and Animal Biotechnology	6	100
2nd YEAR				
10	Paper VIII	Genetic Engineering		100
11	Paper IX	Immunology and Immunotechnology	3	100
12	Paper X	Enzymology and Enzyme Technology	3	100
13	Paper XI	Bioprocess Engineering and Technology	3	100
14	Paper XII	Environmental Biotechnology	3	100
15	Paper XIII	Food and Pharmaceutical Biotechnology	3	100
16	Paper XIV	Bioinformatics, IPR and Bioethics	3	100
17	Practical 3	Lab in Genetic Engineering and Immunology and Immunotechnology,	6	100
18	Practical 4	Lab in Enzymology and Enzyme Technology, Bioprocess Engineering and Technology	6	100
19	Project	Dissertation / Project Work & Viva – Voce [Project report (150) + Viva - Voce (50)]		200
Grand Total Marks				2000

6. PATTERN OF QUESTION PAPER

Model Question Paper Pattern: THEORY

Time: 3 Hours.

Max. Marks: 100

SECTION – A

Answer all the questions: 5 X 5 = 25 Marks
(2 questions from each unit with internal choice)

SECTION – B

Answer all the questions 5 X 15 = 75 Marks
(2 questions from each unit with internal choice)

Model Question Paper Pattern: PRACTICAL

Time: 6 Hours.

Max. Marks: 100

Major	:	40 Marks
Minor	:	20 Marks
Spotters (5x4)	:	20 Marks
Record	:	10 Marks
Viva Voce	:	10 Marks
Total		100 Marks

7. NORMS FOR EXAMINERS

Internal examiner - for evaluation of the theory paper faculty only from the offering M. Sc., Biotechnology course, Periyar University for internal examiner ship should be consider; preferably faculty with minimum of 3 years teaching experience. Examiner panel submitted by the Board of studies to be followed

8. DISSERTATION:

No. of copies / distribution of dissertation:

The students should prepare three copies of dissertation and submit the same for the evaluation by Examiners. After evaluation one copy is to be retained in the college library and one copy is to be submitted to the University (Register) and the student can hold one copy.

Format to be followed:

The formats / certificate for dissertation to be submitted by the students are given below.

Format for the preparation of project work:

- (a) Title page
- (b) Bona fide certificate
- (c) Acknowledgement
- (d) Table of contents

Chapter No:	TITLE	Page no.
1	Introduction	
2	Review of Literature	
3	Materials and Methods	
4	Results	
5	Discussion	
6	Summary	
7	References / Bibliography	

Format of the Title Page:

TITLE OF THE DISSERTATION

Dissertation submitted in part fulfillment of the requirement for the
Degree of Master of Science in Biotechnology to
Periyar Institute of Distance Education (PRIDE),
Periyar University, Salem-636011.

By

Student Name
Register Number
Endroll Number

Under the guidance of

_____ with official Address



Name of the Study Centre with Code

Periyar Institute of Distance Education (PRIDE),
Periyar University, Salem-636011

Year

Format of the Certificate:

CERTIFICATE

This is to certify that the dissertation entitled submitted in part fulfillment of the requirement of the degree of MASTER OF SCIENCE IN BIOTECHNOLOGY to Periyar Institute of Distance Education (PRIDE), Periyar University, Salem is a record of bonafide research work carried out by..... under my supervision and guidance and that no part of the dissertation has been submitted for the award of any degree, diploma, fellowship or other similar titles or prizes and that the work has not been published in part or full in any scientific or popular journals or magazines.

Signature of the Candidate

Signature of the Guide

Study Centre - Coordinator

Director

Examiner 1 :

Examiner 2 :

9. PASSING MINIMUM

The candidate shall be declared to have passed the examination if the candidate secures not less than 50 marks in the University examination in each theory paper.

For the Practical paper, a minimum of 50 marks out of 100 marks in the University examination and the record notebook taken together. There is no passing minimum for record notebook. However submission of a record notebook is a must.

For the project work and viva-voce the candidate should secure 50% of the marks for pass. The candidate should compulsorily attend viva-voce examination to secure pass in that paper.

Candidate who does not obtain the required minimum marks for a pass in a paper/project report shall be required to appear and pass the same at a subsequent appearance.

10. CLASSIFICATION OF SUCCESSFUL CANDIDATES

Candidates who secure not less than 60% of the aggregate marks in the whole examination shall be declared to have passed the examination in **First Class**.

All other successful candidates shall be declared to have passed in the **Second Class**.

Candidates who obtain 75% of the marks in the aggregate shall be deemed to have passed the examination in First Class with Distinction provided they pass all the examination in First Class with Distinction provided they pass all the examinations prescribed for the course at the first appearance.

Candidates who pass all the examinations prescribed for the course in the first instance and within a period of two academic years from the year of admission to the course only are eligible for **University Ranking**.

11. MAXIMUM DURATION FOR THE COMPLETION OF THE PG PROGRAMME

The maximum duration for completion of the PG Programme shall not exceed

4 years .

12. COMMENCEMENT OF THE REGULATION

These regulations shall take effect from the academic year 2007-08, i.e., for students who are to be admitted to the first year of the course during the academic year 2007-08 and thereafter.

13. TRANSITORY PROVISION

Candidates who were admitted to the PG course of study before 2007-2008 shall be permitted to appear for the examinations under those regulations for a period of three years i.e., up to and inclusive of the examination of April/May 2010. Thereafter, they will be permitted to appear for the examination only under the regulations.

1st – YEAR

PAPER - I: CELL BIOLOGY

UNIT - I

Cell Diversity: Cell size shape, cell theory, structure and function of cell organelles in prokaryotic & eukaryotic cells. The cell cycle and programmed cell death: Cell cycle, molecular events in plants and animals. The mechanics of cell division. Cell motility.

UNIT - II

The cytoskeleton: The self assembly and dynamic structure of cytoskeletal filaments, How cells regulate their cytoskeletal filaments; molecular motors, the cytoskeleton and cell behavior. Microtubule motors and movements. Cell-cell interactions: Cell Adhesion proteins, tight and gap junctions, plant cell adhesion and plasmodesmata.

UNIT - III

Energy conversion: Mitochondria and chloroplasts. Electron transport chains and their protein pumps, the genetic system of mitochondria and plastids. The evolution of electron transport chains.

UNIT - IV

Transport of nutrients, ions and macromolecules across membranes. Signal transduction, mechanism and cellular responses to environmental signals. Bio-synthesis of proteins in Eukaryotic cells, Co- and post translational modification, intracellular protein traffic. Protein localization: synthesis of secretory and membrane proteins.

UNIT - V

Cellular basis of differentiation and development-mitosis, gametogenesis and fertilization Development in *Drosophila* and *Arabidopsis*; PM5 spatial and temporary regulation of gene expression.

SUGGESTED READINGS

1. Molecular Biology of the Cell, Alberts, B *et al.* (1994)

2. Molecular Cell biology, Lodish et al.
3. Reproduction in Eukaryotic cells, DM Presco, Academic press.
4. Developmental Biology, SF gillbert, Sinauer Associates Inc.
5. Cell in Development and Inheritance, EB Wilson, MacMillan New York.
6. Cell and Molecular Biology – DeRobertis & DeRobertis (2004)
7. The cell – Cooper *et al.*,
8. The World of Cell –
9. Cell and Molecular Biology , Gerald Karp (1999)
10. Cell Biology, SC. Rastogi (2002)
11. Cell and Molecular Biology, P.K. Gupta, (2002)
12. Essential Molecular Biology, T A Brown, (2001)

UNIT -I

PAPER - II : BIOMOLECULES

Amino acids and peptides- classification, chemical reactions and physical properties. Proteins-classification, hierarchy in structure, Ramachandran map. Protein sequencing, Glyco and lipoproteins-structure and function.

UNIT -II

Sugars-Classification and reactions, Polysaccharides-types, structural features, methods for compositional analysis.

UNIT -III

Lipids-Classification, structure and functions, glycerophospholipids, sphingolipids, cholesterol and its biosynthesis. Polynucleotides: biosynthesis of purines and pyrimidines, de novo and salvage pathway.

UNIT -IV

Secondary metabolites in living systems: Alkaloids, Steroids and Flavonoids. Macromolecules and super molecular assemblies-like membranes, ribosome and chromosomes.

UNIT - V

Hormones : - Definition, classification of hormones, Biological functions and disorders of pancreatic hormone (Insulin), thyroid hormone (thyroxin), pituitary hormone (GH, ADH) and Adrenal medullary hormones (adrenaline, Nor adrenaline).

SUGGESTED READINGS

1. Biochemistry, D. Voet and J.G. Voet, John Wiley & Sons.
2. General Chemistry, Linus Pauling, W.H. Freeman & Company.
3. Organic Chemistry, DJ Cram and GS Hammond, McGraw Hill.
4. Physical biochemistry, D Frefilder, W.H. Freeman & company.
5. Laboratory Techniques in Biochemistry and Molecular Biology, Work and work.
6. Tools of Biochemistry by T.G. cooper.
7. Genes VII, B.Lewin. Oxford University Press.
8. Biochemistry, Lubert Stryer, (1999)
9. Biochemistry, U. Satyanarayana, (2005)
10. Biochemistry, L. Verakumarai (2004)

PAPER –III : MICROBIAL PHYSIOLOGY AND GENETICS

UNIT –I

History and Development of Microbiology. Microbial evolution, systematic and taxonomy-Evolution of earth and earliest life forms; primitive organisms and their metabolic strategies and molecular coding.

UNIT –II

Methods in Microbiology: Pure culture technique; Microbial Growth-The definition of growth, growth curve, Synchronous growth, Continuous, Batch and Fed Batch Culture; Growth as affected by environmental factors like temperature, acidity, alkalinity, water availability and oxygen; Culture collection maintenance and preservation.

UNIT – III

Physiology and Metabolic Diversity among Microorganisms- Nutritional classification of microorganisms- chemoautotrophs, chemoheterotrophs and photosynthetic microorganisms. Photosynthesis in microorganisms; Role of Chlorophylls, Carotenoids and phycobilins; Light and Dark Reaction; Role of anoxic decomposition; Nitrogen metabolism; Nitrogen fixation; Hydrocarbon transformation.

UNIT – IV

Host Parasite Relationships-Normal microflora of skin, oral cavity, gastrointestinal tract; entry of pathogens into the host; colonization and factors predisposing to infections; types of toxins(Exotoxin, Endotoxin and Enterotoxin)and their structure; mode of actions; virulence and pathogenesis.
Antibiotics from prokaryotes; Antifungal antibiotics; Mode of action; Resistance to antibiotics.

UNIT – V

Gene Mutation and Mutagenesis-Mutagens-Radiation and chemical; Types of mutation and their repair mechanism; Ames test for mutagenesis;Methods of genetic analysis. Bacterial Genetic System-Recombination-Transformation, Conjugation, Transduction, Plasmids and Transposons.

SUGGESTED READINGS

1. General Microbiology, Stainer, R. Y., Ingraham, J. L., Whelis, M. L. and Painter, P. R. The Macmillan Press Btd.
2. Brock Biology Microorganism, Madigan, M. T., Martinko, J. M. and Parker, J. Printice-Hall.
3. Microbiology, Pelczar, M. J. Jr., Chan, E. C. S. and Kreig, N. R., Tata McGraw Hill.
4. Microbial Genetics, Maloy, S. R., Cronan, J. E. Jr. and Freifelder, D. Jones, Bartlett Publishers.
5. Microbiology-a Laboratory Manual, Cappuccino, J. G and Sherman, N. Addison Wesley.
6. Microbiological Applications, (A Laboratory Manual in General Microbiology) Benson, H. J. WCG; Wm C. Brown Publishers.
7. Microbiology: Fundamentals and Applications, S. S. Purohit, Published by Agrobios India.
8. Microbial Physiology, S. Meena Kumari (2006).

PAPER – IV : MOLECULAR BIOLOGY

UNIT –I

Introduction to Molecular Biology and Genetic. DNA Replication. Prokaryotic and eukaryotic DNA replication, Mechanics of DNA replication, Enzymes and accessory proteins involved in DNA replication. DNA Repair and Recombination.

UNIT -II

Transcription-Prokaryotic transcription, Eukaryotic transcription, RNA polymerase, General and specific transcription factors, Regulatory elements and mechanisms of transcription regulation, Transcriptional and post-transcriptional gene silencing.

UNIT –III

Translation-Prokaryotic and eukaryotic translation, the translation machinery, Mechanisms of initiation, elongation and termination, Regulation of translation, co-and post-translational modifications of proteins. Protein Localization.

UNIT – IV

Onco-genes and Tumor Suppressor Genes-Viral and cellular onco-genes, tumor suppressor genes from humans, Structure, function and mechanism of action of pRB and p53 tumor suppressor proteins.

UNIT –V

Molecular Mapping of Genome-Genetic and physical maps, physical mapping and map-based cloning, choice of mapping population, simple sequence repeat loci, Southern and fluorescence in situ hybridization in genome analysis: RFLP, RAPD and AFLP analysis, Molecular marker linked to diseased resistance genes, Application of RFLP in forensic, diseases prognosis, genetic counselling, and Pedigree, varietal etc.

SUGGESTED READINGS

1. Molecular Cloning:a Laboratory Manual,J.Sambrook,E.F.Fritsch and I.Maniatis,Cold Spring harbor Laboratory Press,New York,2000.
2. Molecular Biology LabFax. T.A. Brown (Ed.), bios Scientific Publishers Ltds., Oxford,1991.
3. Molecular biology of the Gene (4th Edition),J.D. Watson,N.H. Hopkins,J.W. Roberts,J.A. Steitz and A.M.
4. Molecular Biology of the Cell (2nd Edition)B.Alberts,D.Bray,J.Lewis,M.Raff,K.Roberts,and J.D. Watson, Garland publishing. Inc., New York,1994.
5. Molecular Biology and biotechnology.A comprehensive desk reference.R.A. Meyers(Ed.) VCH Publishers,Inc.,New York,1995.
6. Genomes,T.S.Brown

PAPER - V : PLANT BIOTECHNOLOGY

UNIT – I

Introductory history – laboratory organization, sterilization techniques, nutrition of plant cells, types of media, solid and liquid tissue and organ culture. Initiation and maintenance of callus and suspension culture; single cell clones. Organogenesis; somatic embryogenesis; Shoot-tip culture: rapid clonal propagation and production of virus-free plants.

UNIT - II

Anther, pollen and ovary culture for production of haploid plants and homozygous lines. Cryopreservation, synthetic seed. Plant Transformation Technology: basis of tumor formation, hairy root, features of Ti and Ri plasmid, mechanisms of DNA transfer, role of virulence genes and promoters. Genetic markers, use of reporter genes, reporter gene with introns.

UNIT – III

Application of Transgenic plants and plant Transformation for productivity and performance herbicide resistance, Bt genes, Non-Bt like protease inhibitors, alpha amylase inhibitor, virus resistance, coat protein mediated, abiotic stress, post-harvest losses, long shelf life of fruits and flowers, male sterile lines.

UNIT – IV

Metabolic Engineering and industrial Products: plant secondary metabolites, control mechanisms alkaloids, industrial enzymes, biodegradable plastics, therapeutic proteins, lysosomal enzymes, antibodies, edible vaccines, purification strategies. Somaclonal variation in vitro cultures – causes stability and utilization- genetic and epigenetic basis.

UNIT – V

Conventional plant breeding. Molecular Marker-aided Breeding: RFLP maps, linkage analysis, RAPD markers, AFLP, molecular marker assisted selection. Green house technology. Applications of various techniques for crop improvement in agriculture horticulture and in forestry.

SUGGESTED READINGS

1. J.Hammond,P.McGarvey and V.Yusibov(Eds.):Plant Biotechnology.Springer Verlag,2000.
2. T-J.Fu,G.Singh,and W.R.Curtis(Eds):Plant Cell and Tissue Culture for the Production of Food ingredients.Kluwer Academic/Plenum Press.1999.
3. H.S.Chawla:Biotechnology in Crop improvement.International Book Distributing Company,1998.

4. R.J.Henry:Practical Application of plant Molecular Biology.Chapman and hall.1997.
5. P.K.Gupta:Elements of Biotechnology.Rastogi and Co.Meerut,1996.
6. U. Satyanarayana. Biotechnology, Books and Allied (p) Ltd., 2005. Books and Allied (p) ltd, 83 / 1 Beliaghata Main Road, Kplkata. Rs.395.00

PAPER – VI : ANIMAL BIOTECHNOLOGY

UNIT – I

Structure and organization of animal cell, cell physiology. Equipments and materials for animal cell culture technology. Primary and established cell line cultures.

UNIT -II

Introduction to the balance salt solutions and simple growth medium. Brief discussion on the chemical, physical and metabolic functions of different constituents of culture medium. Role of carbon dioxide. Role of serum and supplements.

UNIT –III

Serum & protein free defined media and their application. measurement of viability and cytotoxicity. Biology and characterization of cultured cells, measuring parameters of growth.

UNIT -IV

Basic techniques of mammalian cell culture in vitro; disaggregation of tissue and primary culture; maintenance of cell culture; cell separation. Scaling-up of animal cell culture. Cell cloning. Application of animal cell culture.

UNIT – V

Stem cell cultures and their applications. Cell culture based vaccines. Somatic cell genetics. Organ and histotypic cultures. Measurement of cell death. Apoptosis.

SUGGESTED READINGS

1. Animal Biotechnology, M.M. Ranga, (2007).
2. Culture of Animal Cells,(3rd Edition),R.Ian Froshney,Wiley-Liss.
3. Animal Cell Culture-Practical Approach,Ed.john R.W.Mesters,Oxford.
4. Cell Culture Lab Fax.Eds.M.Butler & M.Dawson,Bios Scientific Publications Ltd.Oxford.
5. Animal Cell Culture Techniques.Ed.Martin Clynes,Springer.
6. Animal Cell Culture , John. RW. Masters (2000)
7. Instant Notes in Animal Biology, Richard D. Turd, (2003).

PAPER – VII : RESEARCH METHODOLOGY IN BIOTECHNOLOGY

UNIT – I

Spectroscopy : Laws of absorption General principles, instrumentation and applications of UV-visible spectrophotometry, fluorimetry, flame photometry and atomic absorption spectrophotometry. Brief account of NMR, ESR and mass spectrometry in biology.

UNIT – II

Chromatography : Basic principles. Paper and thin layer chromatography. Gas liquid chromatography, Ion-exchange chromatography. Molecular sieve and affinity chromatography. HPLC.

UNIT - III

Electrophoresis & Centrifugation General principles. Paper electrophoresis. Agarose gel electrophoresis. Pulsed field gel electrophoresis. Iso electric focusing. Polyacrylamide gel electrophoresis. SDS PAGE. Basic principles of sedimentation. Principles and techniques of preparative centrifugation. Subcellular fractionation. Density gradient centrifugation. Molecular weight determination. Ultra centrifugation.

UNIT – IV

Radioisotope techniques : Nature and units of radioactivity. Detection and measurement of radioactivity- Geiger and scintillation counters. Autoradiography. Applications of radioisotopes in biology. Radiation hazardous.

UNIT – V

Collection, classification and tabulation of biological data. Data processing and its analysis (mean, median, mode, standard deviation, standard error, correlation, regression and ANOVA). Research and its classification, planning, formulation and design. Review of literature – Manuscript and Dissertation (Thesis) preparation.

SUGGESTED READINGS

1. Wilson and Walker practical Biochemistry principles and Techniques. Cambridge University press 2000.
2. Physical Biochemistry: Application to biochemistry and Molecular Biology. Friefelder
3. Biophysical chemistry - Principles and Techniques. Upadhyay, Upadhyay and Nath Himalaya publications.
4. Modern Experimental Biochemistry. Boyer III Edition Benjamin Cummings.
5. Research methodology by P. Saravanel 2003.

PRACTICAL –I : LAB IN CELL BIOLOGY, BIOMOLECULES, MICROBIAL PHYSIOLOGY & GENETICS AND MOLECULAR BIOLOGY

CELL BIOLOGY

1. Principles of Microscopy and Optics.
2. Microtomy
3. Cell Size Determination
4. Staining (simple and Gram)
5. Mitosis and Meiosis

BIOMOLECULES

1. Reactions of amino acids, sugars and lipids.
2. Isolation, purity determination and quantization of cholesterol, DNA and RNA
3. Quantitation of Proteins and Sugars.

MICROBIAL PHYSIOLOGY

1. Preparation of liquid and solid media for growth of microorganisms.
2. Isolation and maintenance of organisms by plating, streaking and serial dilution methods, slants and stab cultures.
3. Isolation of pure cultures from soil and water.
4. Growth; Growth curve, Measurement of bacterial population by turbidometry and serial dilution methods
5. Microscopic examination of bacteria, yeast and molds and study of organisms by Gram stain, Acid fast stain and staining for spores.

MOLECULAR BIOLOGY

1. Isolation of genomic DNA.
2. Isolation of plasmid RNA.
3. Isolation of antibiotic resistance mutants
4. RFLP

PRACTICAL II : LAB IN PLANT AND ANIMAL BIOTECHNOLOGY

PLANT BIOTECHNOLOGY

1. Preparation of media.
2. Surface sterilization
3. Organ culture.
4. Callus propagation, transfer of plants to soil.
5. Protoplast isolation and culture.
6. Anther culture
7. Green house - Demonstration

ANIMAL BIOTECHNOLOGY

1. Preparation of tissue culture medium
2. Preparation of single cell suspension from spleen and thymus.
3. Cell counting and cell viability.
4. Cryopreservation and thawing.
5. Measurement of doubling time.
6. Role of serum in cell culture.
7. preparation chick embryo fibroblast culture (monolayer)

2nd YEAR

PAPER –VIII : GENETIC ENGINEERING

UNIT –I

Scope of Genetic Engineering Milestones in Genetic Engineering-Isolation enzymes,DNA sequencing,synthesis and mutation,detection and separation,cloning,gene expression.Cloning and patenting life forms.Genetic engineering guidelines. Molecular Tools and Their Applications-Restriction enzymes,modification enzymes,DNA and RNA markers.Nucleic Acid Purification,

UNIT – II

Nucleic Acid Amplification and its Applications. Gene Cloning Vectors Plasmids,bacteriophages,phagemids,cosmids.Artificial chromosomes.Restriction Mapping of DNA fragments and Map Construction.

UNIT – III

cDNA Synthesis and Cloning-mRNA enrichment,reverse transcription,DNA primers,linkers,adaptors and their chemical synthesis,Library construction and screening.Alternative Strategies of Gene Cloning-Cloning interacting genes.Two and three hybrid systems,cloning differentially expressed genes.Nucleic acid microarray arrays. Site-directed Mutagenesis and Protein Engineering. Gene Regulation - DNA transfection, Northern blot, Primer extension, SI mapping, RNase protection assays, Reporter assays.

UNIT – IV

Expression Strategies for Heterologous Genes-Vector engineering and codon optimization, host engineering, in vitro transcription and translation, expression in bacteria, expression in yeast, expression in insects and insect cells, expression in mammalian cells, expression in plants. Processing of Recombinant proteins-Purification and refolding, characterization of recombinant proteins, stabilization of proteins.

UNIT – V

T-DNA and Transposon Tagging-Role of gene tagging in gene analysis, T-DNA and Transposon tagging, Identification and isolation of genes through T-DNA or transposon. Transgenic and GeneKnockout Technologies.

SUGGESTED READINGS

1. Molecular Cloning: a Laboratory Manual, J. Sambrook, E. F. Fritsch and T. Maniatis, Cold Spring Harbor Laboratory Press, New York, 2000.
2. DNA Cloning: a practical Approach, D. M. Glover and B. D. Hames, IRL Press Oxford, 1995.
3. Kaufman, W. Wu., D. Kim and L. J. Cseke, CRC Press, Florida, 1995.
4. Methods in Enzymology Vol. 152, Guide to Molecular Cloning Techniques, S. L. Berger and A. R. Kimmel, Academic Press, Inc. San Diego, 1998.
5. Methods in Enzymology Vol. 185, Gene Expression Technology, D. V. Goeddel, Academic Press, Inc., San Diego, 1990.
6. DNA Science. A First Course in Recombinant Technology, D. A. Mickless and G. A. Greyer, Cold Spring Harbor Laboratory Press, New York, 1990
7. Molecular Biotechnology (2nd Edn.), S. B. Primorso, Blackwell Scientific Publishers, Oxford, 1994.
8. Route Maps in Gene Technology, M. R. Walker and R. Repley, Blackwell Science Ltd. Oxford, 1997.
9. Genetic Engineering. An Introduction to gene analysis and exploitation in eukaryotes. S. M. Kingsman and A. J. Kingsman, Blackwell Scientific Publications. Oxford, 1998.
10. Molecular Biotechnology-Glick.

PAPER –IX : IMMUNOLOGY AND IMMUNOTECHNOLOGY

UNIT – I

Histroy and scope of Immunology – Types of Immunity. Anatomy of lymphoid organs; primary and secondary lymphoid organs. Immunoglobulin structure, function and synthesis; memory cells,

UNIT – II

Major histocompatibility complex-cells of the immune system,haematopoesis and differentiation,lymphocyte trafficking,B-lymphocytes,T-lymphocytes,macrophages,dendritic cells,langerhan cells,Natural killer cells and lymphokine activated killer cells,eiosinophils amd neutrophils.

UNIT – III

Regulation of immune response-antigen processing and presentation, generation of humoral and cell mediated immune responses; activation of B and T-lymphocytes, cytokines, and their role in immune regulation. T-cell regulation, MHC restriction.

UNIT – IV

Cell mediated cytotoxicity: Mechanism of T-cell - Antibody dependent cell mediated cytotoxicity, macrophage mediated, cytotoxicity, Hypersensitivity, Autoimmunity, transplantation, Tumor immunology, AIDS and other Immunodeficiencies.

UNIT – V

Antigen – Isolation, purification and characterization of various antigen and haptens from pathogens. Production of antibodies, purification of antibodies. Antigen – antibody reaction, Hybridoma and monoclonal antibody production; Immuno-diagnosis and applications of monoclonal antibodies in biomedical research; human monoclonal antibodies.

SUGGESTED READINGS

1. Text Book on principles of Bacteriology,virology and Immunology, Topley and Wilson's(1995). Edward Arnold,London.
2. Fundamentals of Immunology,William paul.
3. Immunology,By Roitt and others.
4. Roitt,I.M.(1998) Essentials of Immunology,ELBS,Blackwell Scientific publishers,London.
5. Immunology by Abbas.
6. Microbiology by Pelczar,Chan and Krieg.TMH.

PAPER - X: ENZYMOLOGY AND ENZYME TECHNOLOGY

UNIT – I

Enzyme classification and nomenclature of enzymes according to IUB. Intracellular localization of enzymes, homogenization techniques, isolation and fractionation of enzymes by precipitation, gel filtration, chromatography and ultra centrifugation technique.

UNIT – II

Order of reaction, Activation energy. Kinetics of enzyme catalysed reaction – Steady state kinetics, Michaeli's Menten Equation and its transformation.

UNIT – III

Determination of the Active site of the enzyme and amino acid present. ES Complex formation-Evidence for the existence. Mechanism of action of lysozyme, and carboxy peptidase. Nucleophilic and Electrophilic attack. Role of metal ions in enzyme catalysis.

UNIT – IV

Enzyme inhibitors - kinetics of competitive, non-competitive and uncompetitive inhibitors. Allosteric interaction mechanism of enzyme catalysis, includes acid base catalysis, Covalent, metal ion, eletrostatic proximity and orientation effect. Immobilisation of enzyme – Methods.

UNIT – V

Structure and function of co enzyme – Reaction involving phosphate, Nicotinamide, Flavin nucleotides, Co enzyme A, and Biotin. Co enzymes in one carbon transfer. Clinical and industrial application of enzymes – Enzyme engineering – site directed mutagenesis.

SUGGESTED READINGS

1. Biological chemistry by H.R. Mahier and E. Cordes (1986)
2. Enzymes by Dizon and Webb.
3. Genes VI by Benjamin Lewin (1997).
4. Principles of Biochemistry by Albert Lehninger.

PAPER - XI: BIOPROCESS ENGINEERING AND TECHNOLOGY

UNIT – I

Introduction to bioprocess engineering; Isolation and screening of industrially important microbes. Primary & Secondary detection & assay of fermentation products. Improvement of the strains for increased yield and other desirable characteristics. Advantages of bioprocess over chemical process.

UNIT – II

Basic principles in bioprocess. Fermentations - Submerged, solid state and immobilization. Media formulation. Sterilization. Thermal death kinetics. Batch and continuous sterilization systems, Sterilization of air. Fibrous filters.

UNIT – III

Bioreactor design, parts and their functions. Types of reactors CSTR, Tower, Jet loop, Airlift, Bubble column, Packed bed. Immobilized cells. Enzyme co-immobilization. Some examples of bioprocess for the production of biomass. Primary and Secondary metabolites, extracellular enzymes, biotechnologically important intracellular products, copolymers.

UNIT – IV

Transport phenomenon in bioprocess – Mass transfer, Mass transfer coefficient for gases and liquids. Dimensionless groups. Mass transfer resistance. Rate of oxygen transfer. Determination of oxygen transfer coefficients. Biological properties of medium. Biological heat transfer.

UNIT – V

Bioprocess control and monitoring of variable such as temperature, agitation, pressure, pH. On line measurement. On / Off control. Elementary idea of Canning & Packing, Sterilization & Pasteurization and preservation of food products.

SUGGESTED READINGS

1. Fundamentals of Biotechnology by P.Prave A.Faust W.Sitting and D.A.Sankaseh (1987) WCH Weinhein.
2. Principles of Fermentation technology by P.F. Stanbury, and A.Whitakor (1984). Pergamon Press.
3. Chemical Engineering by J.M Coulson and J.F.Richaxlson (1984) Progamon press P.a.
4. Microbial Biotechnology by Glazer and Niteaid D (1995) WH Framan & co New York.
5. Industrial Biotechnology by Casida.

PAPER – XII: ENVIRONMENTAL BIOTECHNOLOGY

UNIT - I

Environmental Pollution : Types of pollution, Methods for measurement of pollution; Methodology of environmental management – The problem solving approach and its limitations. Air pollution and its control through biotechnology.

UNIT -II

Water pollution and its control: Water as a scarce natural resource, Need for water management, Measurement of water pollution, Sources of water pollution, Waste water collection, Waste water treatment – Physical, chemical and biological treatment processes

UNIT – III

Microbiology of waste water treatments: Aerobic process, Activated sludge, Oxidation ditches, Trickling filters, 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, sugar, antibiotic industries.

UNIT – IV

Microbiology of degradation of Xenobiotics in environment: Ecological considerations, decay behaviour & degradative plasmids; Hydrocarbons, substituted hydrocarbons, oil pollution, surfactants, pesticides. Bioremediation of contaminated soils and wasteland.

UNIT – V

Solid wastes: Sources and management (Composting, vermiculture and methane production). Global environmental problems: Ozone depletion, UV-B, Green house effect and acid rain, their impact and biotechnological approaches for management.

SUGGESTED READINGS

1. Environmental sciences and Biotechnology: Theory & Techniques, A. G> Murugasan and C. Rajakumari (2005). Rs. 290.
2. Environmental Microbiology – K. Vijaya Ramesah (2004). Rs. 180
3. Industrial and Environmental Biotechnology – Ahmed 2004. Rs. 595.
4. Gobar Environmental Biotechnology – Wise (2005). Rs. 595.
5. Environmental Biotechnology – K. G. Agarwall (2005) Nidhi Publishers
6. Environmental Science and Biotechnology: Theory & techniques, A. G. Murugasan and C. Rajakumari, (2005).

PAPER – XIII : FOOD AND PHARMACEUTICAL BIOTECHNOLOGY

UNIT – I

Dairy Products: Cheese – principles of cheese making, general methods, cheddar cheese, swiss cheese, surface ripened cheese, cheese spoilage and public health – *Styphylococcal*, *salmonellosis*, *E.coli*, *Butalism*, Aflatoxin and amine production

UNIT – II

Fermented Foods: Soy sauce, Miso, tempeh, ontiom, hamantto, sufu, Natto, idli, Ang-kak fermented fish products. Saucer krant, pickles, fermentation of olives, fermented sausages. Production of bread, organic acids, acetic acid, lactic acid and citric acid, amino acids glutamic acid.

UNIT –III

Production of food flavourants and pigments. Production of distilled beverage, alcohol, wine, brandy and beer. Single cell protein and Baker's yeast. Food industry enzymes.

UNIT – IV

Historical perspective, influences of molecular biology on drug discovery. Random screen up. Target identification and validation, organic synthesis in drug discovery.

UNIT – V

Synthesis of secondary metabolites from plants- Drug discovery in cancer research – Vaccine development – Molecular diagnosis tool development – Detection of mutations identification of antigen / antibody. Biosensors.

SUGGESTED READINGS

1. Industrial Microbiology – Prescott and Dunn's Gerald Reed (1983) – 4th Edn. AVI publishing Company Inc. Connecticut.
2. Genetic Engineering Applications for Industry, 1981. Paul JK, Noyer Cooperation, New Jersey.
3. Fundamentals of food Processing, 1980. Toledo RT. AVI publishing company., USA.
4. Science Vol. 287, 17 march 2000. Whole Issue.
5. Protein Targets for structure-based drug design, 1992, p 317-372. Walkindshaw, Ned, Res. Rev.
6. Molecular Modeling in drug Design, 1985, p 573-659, Marshall, GR.

PAPER – XIV : BIOINFORMATICS, IPR, AND BIOETHICS

UNIT – I

Bioinformatics: Use of databases in biology sequence databases, structural databases, Sequence Analysis – protein and nucleic acids, Structural comparisons, genome projects.

UNIT – II

Information theory and biology: Entropy, Shannon's formula, divergences from equiprobability and independence, Markov chains, ergodic processes, redundancy, application to DNA and protein sequences.

UNIT – III

Microarray data analysis : Microarray data analysis methods, tools and resources and sequence sampling and SAGE (serial analysis of gene expression). Proteomic data analysis – Analyzing data from 2D-PAGE gels and analyzing protein mass spectrometry data. Bioinformatics in pharmaceutical industry : Drug discovery and pharmainformatics resources

UNIT - IV

Intellectual Property Right: WTO-GATT and TRIPS. Different types of intellectual property rights – Patents – Plant breeder's rights. Patent application – Rules governing patents. Examples of patents in biotechnology. Special application of patent laws in biotechnology.

UNIT - V

Biosafety: Definition – requirement- Biosafety for human and environment - General guidelines – Guidelines for rDNA research activity – Containment facilities and Biosafety practices – Guidelines for research in transgenic plants and applications. Social and ethical issue.

SUGGESTED READINGS

1. Molecular databases for protein sequence and structure studies by Sillince, JA and Sillince M (1991) springer Verlag.
2. Sequence Analysis primer by M. Gribskov, J. Devereux (1989) Stockton Press.
3. Information theory and living systems by L.I. Garfield, (1992) Columbia University Press.
4. Recombinant DNA safety guidelines, Department of Biotechnology, Ministry of Science & Technology, Government of India
5. Instant Notes – Bioinformatics David R. Westhead, J. Howard Parish and Richard M. Twyman. Viva Books private Limited, Chennai.

PRACTICAL III : LAB IN GENETIC ENGINEERING AND IMMUNOLOGY AND IMMUNOTECHNOLOGY

GENETIC ENGINEERING

1. Bacterial culture and antibiotic selection media. Preparation of competent cells.
2. Isolation of Lambda phage DNA.
3. Quantitation of nucleic acids.
4. Restriction Digestion
5. Ligation
6. Transformation using bacterial culture

IMMUNOLOGY AND IMMUNOTECHNOLOGY

1. Blood grouping
2. Blood Cell Analysis
3. Lymphocyte subset identification and enumeration
4. Preparation of Antigen- Protocol of Immunization
5. Immunodiffusion and Radial Immuno-diffusion tests
6. Antigen-Antibody reaction – Precipitation & Agglutination reaction tests

PRACTICAL IV : LAB IN ENZYMOLOGY AND ENZYME TECHNOLOGY AND BIOPROCESS ENGINEERING AND TECHNOLOGY

ENZYMOLOGY AND ENZYME TECHNOLOGY

1. Isolation of Extra cellular Enzymes.
2. Isolation of Intra Cellular Enzymes.
3. Assay of Enzyme (Protease) activity
4. Enzyme Immobilization.

BIOPROCESS ENGINEERING AND TECHNOLOGY

1. Isolation of industrially important microorganisms for microbial processes.
2. Determination of thermal death point (TDP) and thermal death time (TDT) of microorganism for design of a sterilizer.
3. Comparative studies of Ethanol production using different substrates.
4. Microbial production of citric acid using *Aspergillus niger*.
5. Microbial production of antibiotics (*Penicillin*).
6. Production and estimation of Alkaline Protease.
7. Use of alginate for cell immobilization.