

MAHENDRA ARTS AND SCIENCE COLLEGE

(AUTONOMOUS)

Accredited with 'A' grade by NAAC, Recognized u/s 2(f) & 12 (B) of the UGC Act 1956

Affiliated to Periyar University

KALIPPATTI, NAMAKKAL (Dt.) – 637 501



DEGREE OF MASTER OF SCIENCE

CHOICE BASED CREDIT SYSTEM

SYLLABUS FOR M.Sc. BIOTECHNOLOGY

FOR THE STUDENTS ADMITTED FROM THE

ACADEMIC YEAR 2016 – 2017 ONWARDS

M.Sc., BIOTECHNOLOGY REGULATIONS

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, BHMS 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.

Duration of the Course:

The Course for the degree of Master of Biotechnology shall consist of two academic years divided into four semesters. Each semester consist of 90 working days.

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.

Examinations:

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

The practical examinations for PG course should be conducted at the end of the semester. At the end of the 4th Semester Viva-Voce will be conducted on the basics of the Dissertation / Project report submitted by the student. One internal and one external examiner the Viva-Voce will be conducted by jointly.

Pattern of Question paper
Model Question Paper Pattern: Theory
(Including the special paper – Human Rights)

Time : 3Hours

Max.Marks:75

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

10 x 5 = 50 Marks

(2 Question from each unit with internal choice)

Model Question Paper Pattern: Practical

Time : 7 Hours

Max.Marks : 60

Major	:	20 Marks
Minor	:	10 Marks
Spotters(5x4)	:	20 Marks
Record	:	5 Marks
Viva Voce	:	5 Marks
Total	:	50 Marks

Norms for examiners:

Internal examiner – for evaluation of theory papers : Faculty only from the colleges offering M.Sc., Biotechnology course, Periyar University for Internal examiner ship should be considered; Preferably faculty with minimum of 3 years teaching experience. Examiners panel submitted by the Board of studies to be followed.

Faculty Eligibility:

M.Sc., Degree in Biotechnology, Microbiology, Biochemistry, Botany, Zoology, Immunology, Plant Science, Life Science with SLET, National level Eligibility Test (NET) or Ph.D., in the relevant field.

Dissertation:**No. of Copies / Distribution of dissertation:**

The students should prepare three copies of dissertation and submit the same for the evaluation by Examiners.

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) Bonafide certificate
- (c) Acknowledgement
- (d) Table of contents

CONTENTS

S. No:	Title	Page No.
1	Introduction	
2	Review of Literature	
3	Materials and Methods	
4	Results	
5	Discussion	
6	Summary	
7	Reference, Bibliography	

Format of the Title Page:

Title of the Dissertation

Dissertation submitted in partial fulfillment of the requirement for the Degree of Master of
Science in Biotechnology to the Periyar University,
Salem – 636 011.

Student Name

Register Number

College

Year

Format of the Certificate:

CERTIFICATE

This is to certify that the dissertation entitled _____

Submitted in partial fulfillment of the requirement of the degree of Master of Science in Biotechnology to the College 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 Guide

Signature of the Head

Examiner 1

Examiner 2

Passing Minimum :

The candidate shall be declared to have passed the examination if the candidate secure not less than 50% of marks in the internal and university examination in each theory paper.

For the practical paper, a minimum of 50 percentage marks out of the stipulated maximum marks in the internal and 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 in the internal and university examinations. The candidates should compulsory attend viva – voce examination to secured 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.

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 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.

Maximum Duration for the completion of the PG Programme

The maximum duration for completion of the PG programme shall not exceed 8 semesters.

Commencement of this regulation

These regulation shall taken effect from the academic year 2015-2016, i.e., for students who are to be admitted to the first year of the course during the academic year 2015-16 and thereafter.

Transitory Provision

Candidates who were admitted to the PG course of study before 2015-2016 shall be permitted to appear for the examination under those regulations for a period of three years i.e., up to and inclusive of the examination of April / May 2018. Thereafter, they will be permitted to appear for the examination only under the regulations then in force.

MAHENDRA ARTS AND SCIENCE COLLEGE
(Autonomous)
DEPARTMENT OF BIOTECHNOLOGY
M.Sc., Biotechnology – Course Structure (CBCS Pattern- 2016-2017 Onwards)

Part	Sem.	Paper Code	Title of the Paper	Credits	Lecture Hrs/Wk	Int. Marks	Ext. Marks
Core I	I	M16PBT01	Cell Biology	4	4	25	75
Core II		M16PBT02	Biological Chemistry	4	4	25	75
Core III		M16PBT03	Molecular Biology	4	4	25	75
Core IV		M16PBT04	Microbiology	4	4	25	75
Elective			Elective	3	4	25	75
Core Practical-I		M16PBTP01	Lab in Cell Biology & Biological Chemistry	4	5	40	60
Core Practical-II		M16PBTP02	Lab in Microbiology & Molecular Biology	4	5	40	60
				27			
Core V	II	M16PBT05	Genetic Engineering & rDNA Technology	4	4	25	75
Core VI		M16PBT06	Immunology	4	4	25	75
Core VII		M16PBT07	Bioprocess Technology	4	4	25	75
Elective			Elective	3	4	25	75
EDC			EDC	4	4	25	75
Core Practical-III		M16PBTP03	Lab in Genetic engineering and rDNA technology	4	4	40	60
Core Practical-IV		M16PBTP04	Lab in Immunology and Bioprocess technology	4	4	40	60
Part- IV		M16PHR01	Human Rights	2	2	25	75
				29			
Core VIII	III	M16PBT08	Plant Biotechnology	4	4	25	75
Core IX		M16PBT09	Animal Biotechnology	4	4	25	75
Core X		M16PBT10	Environmental Biotechnology & Nanotechnology	4	4	25	75
Core XI		M16PBT11	Proteomics & Genomics	4	4	25	75

Elective			Elective	3	4	25	75
Core Practical-V		M16PBTP05	Lab in plant & Animal Biotechnology	4	5	40	60
Core Practical-VI		M16PBTP06	Lab in Environmental Biotechnology, Proteomics and Genomics	4	5	40	60
				27			
Core XII	IV	M16PBT12	Research methodology & Research Proposal Development.	4	5	25	75
Project		M16PBTPR1	Project	4	23	25	75
Internship		M16PBTIS01	Internship	2	2	-	100
				10			
Total credits				93			

LIST OF ELECTIVES

SEM	Paper Code	Title of the Paper	Credits	Marks		
				Lecture Hrs/Wk	Int. Marks	Ext. Marks
I	M16PBTE01	Biophysics & Bioinstrumentation	3	4	25	75
	M16PBTE02	Soil Science	3	4	25	75
	M16PBTE03	Human Physiology	3	4	25	75
	M16PBTE04	Horticulture	3	4	25	75
II	M16PBTE05	Stem cell Biology & Tissue Engineering	3	4	25	75
	M16PBTE06	Industrial safety	3	4	25	75
	M16PBTE07	Clinical Biochemistry	3	4	25	75
	M16PBTE08	Aquaculture	3	4	25	75
III	M16PBTE09	Biostatistics	3	4	25	75
	M16PBTE10	Marine Biotechnology	3	4	25	75
	M16PBTE11	Cancer Biology	3	4	25	75
	M16PBTE12	Apiculture	3	4	25	75

LIST OF EXTRA DISCIPLINARY COURSE

SEM	Paper Code	Title of the Paper	Credits	Marks		
				Lecture Hrs/Wk	Int. Marks	Ext. Marks
II	M16PBTED1	Vermicomposting Technology	4	4	25	75
	M16PBTED2	Health care and environmental biotechnology	4	4	25	75

SEMESTER - I

Part	Paper Code	Title of the Paper	Credits	Lecture Hrs/Wk	Int. Marks	Ext. Marks
Core I	M16PBT01	Cell Biology	4	4	25	75
Core II	M16PBT02	Biological Chemistry	4	4	25	75
Core III	M16PBT03	Molecular Biology	4	4	25	75
Core IV	M16PBT04	Microbiology	4	4	25	75
Elective		Elective	3	4	25	75
Core Practical-I	M16PBTP01	Lab in Cell Biology & Biological Chemistry	4	5	40	60
Core Practical-II	M16PBTP02	Lab in Microbiology & Molecular Biology	4	5	40	60
			27			

CELL BIOLOGY – M16PBT01

UNIT I

Cell Theory, Emergence of modern cell biology, Structure of Prokaryotic and Eukaryotic cells- Cell-wall, Membrane, Cell organelles-organization and functions, Nucleus, Mitochondria, Plastids; Endoplasmic Reticulum, Golgi complex, Lysosomes, Microtubules, Centriole, Vacuole, Cytoskeleton, Cilia and Flagella.

UNIT II

Chromosome structure and functions – Giant chromosomes, Lamp brush and Polytene Chromosomes, Karyotype analysis, Chromosome abnormalities.

UNIT III

Cell cycle control and cell death: overview of cell cycle-control system, Regulation of the Cell Cycle, Mitosis, Meiosis, Molecular control involving checkpoints in cell division cycle. Differentiation, Cellular senescence.

UNIT IV

Cell signaling – types , Chemical signals and cellular receptors ,G Protein-linked receptors, Protein Kinase-associated receptors, Growth factors as messengers, Cell signals and Apoptosis, Cytoskeleton: microfilaments-intermediate filaments-microtubules.

UNIT V

Development of Multicellular organisms- yeast, *Caenorhabditis elegans* and *Arabidopsis thaliana*, *Drosophila melanogaster*, Stem cells, types, use of stem cells to repair damaged tissues.

REFERENCES

1. Molecular Biology of the cell, Alberts, B et al. (1994)
2. Molecular Cell Biology , Lodish et al.
3. Reproduction in Eukaryotic cells, D.M.Presco, Academic Press.
4. Developmental Biology, SF.Gillbert, Sinaur Associates Inc.
5. Cell in Development and Inheritance, EB Wilson, MacMillan, New York.
6. Molecular Biology of steroid and nuclear hormone receptors, LP Freeman, Birkhuser.
7. Cell and Molecular Biology- DeRobertis and DeRobertis (2004)
8. Cell and Molecular Biology, Gerald Karp (1999)
9. Cell and Molecular Biology, P.K.Gupta, (2002)
10. The world of Cell-Becker,W.M *et.al.*6th edition.Pearson Education.2007.

BIOLOGICAL CHEMISTRY - M16PBT02

UNIT I

Principles of thermodynamics- First and second laws of Thermodynamics. Free energy – Concepts of metabolism: Types- Catabolism and anabolism with reference to pathways- pH, pK, acids, bases, buffers. Bonds in biomolecules – weak and strong bonds.

UNIT II

Sugars-Classification and reactions, polysaccharides-types, structural features, methods for compositional analysis. EMP pathway, TCA cycle. Lipids-Classification, structure and functions. Beta oxidation of fatty acids cholesterol biosynthesis

UNIT III

Aminoacids -Classification, chemical reactions. Proteins-Classification, hierarchy in structure, Ramachandran plot. Protein sequencing, Glyco and Lipoproteins- Structure and function. Biosynthesis of purines and pyrimidines, de Novo and salvage pathway.

UNIT IV

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

UNIT V

Vitamins-Fat soluble and water soluble vitamins, Minerals, role of vitamins and minerals in human health. Hormones: Definition, Classification of hormones. Biological functions and disorders of pancreatic hormone (Insulin), thyroid hormone (Thyroxin), Hypothalamus and pituitary hormone (GH,TSH,GTH,ADH) and Adrenal gland (Adrenaline, Nor adrenaline). Hormones and reproduction-Hormones in pharmaceuticals.

REFERENCES

1. Biochemistry, D.Voet and J.G.Voet, John Wiley and Sons.
2. Biochemical Calculations, Irwin H.Segal, John Wiley and Sons Inc.
3. Text Book of Biochemistry.Devlin,T.M.,John Wiley and Sons.Inc.
4. Understanding Chemistry, CNR Rao, Universities Press, Hyderabad, 1999.
5. Principle of Biochemistry. Lehninger,A.L.,Nelson,D.L and Cox,M.M.2002.CBS Publishers
6. Biochemistry, Stryer, L., 2002, Fifth edition. W.H.Freeman and co
7. Biochemistry, U.Satyanarayana, (2005)
8. Fundamentals of Biochemistry, J.L.Jain (1999)

MOLECULAR BIOLOGY -M16PBT03

UNIT I

Introduction of molecular biology, Central dogma of molecular Biology. DNA Replication. Prokaryotic and Eukaryotic DNA replication, Mechanism of DNA replication, Enzymes and accessory proteins involved in DNA replication. DNA Repair – light and dark mechanisms.

UNIT II

Transcription-Prokaryotics transcription, Eukaryotics transcription, RNA polymerase, General and specific transcription factors, Regulatory elements and mechanisms of transcription regulation, Transcriptional and post-transcriptional gene silencing. Modifications in RNA. 5' cap formation, transcription, 3'-end processing and Polyadenylation, Splicing, Editing, Nuclear export of mRNA.

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. Synthesis of Secretory and membrane proteins, import into nucleus, mitochondria and chloroplast.

UNIT IV

Oncogenes and Tumor Suppressor Genes-Viral and cellular oncogenes, tumor suppressor genes from humans, Structure ,function and mechanisms 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, Southern and fluorescence in situ hybridization in genome analysis, RFLP, RAPD and AFLP analysis, Molecular markers linked to disease resistance genes, Application of RFLP in forensic, disease prognosis, genetic counseling.

REFERENCES

1. Molecular cloning: A Laboratory Manual, J.Sambrook, E.F.Ritsch and I.Maniatis, Cold Spring Hratbor Laboratory Press, New York, 2000.
2. Introduction to Practical Molecular Biology, P.D.Dabre, John Wiley and Son Ltd. New York, 1988.
3. Molecular Biology, Labfax, T.A.Brown, Bioscientific publishers ltd, Oxford, 1991.

4. Molecular Biology of gene(4th Edition), J.D.Watson, N.H.Hopkins, J.W.Roberts, J.A.Steitz and A.M.Weiner. The Benjamin/Cummings publications C Inc.California, 1987.
5. Molecular Cell Biology (2nd Edition, J.Darnell, H.Lodish and D.Baltimore, Scientific American Book, USA, 1994.
6. Gene VII Benjamin Lewin. Oxford University Press. U.K.
7. Molecular Biology and Biotechnology. A comprehensive dies reference. R.A.Meyers (Edition).VCH Publishers, Inc., New York, 1995.
8. Genomes, T.S.Brown.
9. Molecular Biology and Biotechnology. J.M.Walker and R.Rapley. 2005.

MICROBIOLOGY - M16PBT04

UNIT I

History and development of microbiology. Microscopy- bright field, dark field, Electron. Sterilization, Control of microorganisms by physical and chemical methods. Bacterial taxonomy and classification according to Bergy's manual. Stains and staining methods-simple, differential and special staining.

UNIT II

Microbial Growth-mathematical expression of growth, growth curve, measurement of growth. Synchronous culture and Continuous culture. Factors affecting microbial growth. Culture media and their types. Pure Culture Techniques-Serial dilution methods - spread plate – pour plate – streak plate technique. Culture collection and preservation of microbial cultures.

UNIT III

Nutritional requirements and types of microorganisms, uptake of nutrients by microorganisms. Photosynthetic microorganisms. Nitrate and sulfur oxidizing bacteria, nitrate and sulfate reducing bacteria. Nitrogen fixation. Hydrocarbon transformation. Role of microorganism in agriculture, food and dairy industry.

UNIT IV

Host – parasite relationship, normal microflora. Causative agent, pathogenesis and control measures of typhoid, cholera, tuberculosis, AIDS, hepatitis, malaria and candidiasis. Antimicrobial agents and their mode of action – antibacterial, antiviral, antifungal, antiparasitic agents.

UNIT V

Mutation and Mutagenesis; UV and chemical mutagens; Types of mutation; Ames test for mutagenesis; Methods of genetic analysis – Transformation, Conjugation, Transduction, Recombination. Plasmids and Transposons. Bacterial genetic maps with reference to *E. coli* – Viruses and their genetic system – Phage life cycle, Genetic systems of yeast and Neurospora .

REFERENCES

1. Pelczar MJ , Chan ECS, and Krieg NR, (2006) Microbiology,5th Edition Tata McGraw Hill Publishing Company.
2. Prescott LM, Harley JP and Klein DA (2005) Microbiology, 6th Edition.

McGraw Hill.

3. Talero KP and Talero A (2002): Foundations in Microbiology. 4th Edition McGraw Hill.
4. Anantha Narayanan R and Panikar CKJ (2002). 6th Edition. Orient Longman Pvt.Ltd
5. Benson HJ (1999), Microbiological Applications: A Laboratory manual in General Microbiology.7th Edition. McGraw Hill.
6. Modi HA (1995), Elementary Microbiology (Volume- 1 Fundamentals of Microbiology).Akta Prakashan Nadiad Publication.
7. Freifelder D (1995), Microbial Genetics, Narosa Publishing House.
8. Maloy SR, Cronan JE and Freifelder D Microbial Genetics, Jones Barlett Publishers.
9. Cappuccino JG and Sherman N (1996). Microbiology - a laboratory Manual. 5th edition. Editors: Wirth AE and Olsen L.

ELECTIVE – I- BIOPHYSICS & BIOINSTRUMENTATION - M16PBTE01

UNIT I

Scope and methods of Biophysics. Understanding various structure of proteins, globular and fibrous protein; protein stability; protein folding. The physics of nucleic acids: Forces stabilizing structures; Double helical structures, properties and forms of DNA.

UNIT II

Colorimeter-Ber Lambert's law, UV-Visible spectroscopy, Atomic absorption spectroscopy, Flame photometer, IR and Raman Spectroscopy, Spectrofluometry, Mass Spectrophotometry- Matrix assisted layer desorption ionization and surface enhanced laser desorption ionization.

UNIT III

Centrifugation – Basic Principle of Centrifugation, Instrumentation of Ultracentrifuge (Preparative, Analytical), Rate-Zonal centrifugation, sedimentation equilibrium Centrifugation. Electrophoresis (Gel Electrophoresis, Paper Electrophoresis).

UNIT IV

Chromatography- Paper chromatography- Thin layer chromatography-Column chromatography- LPCC and HPLC, Affinity chromatography, Partition chromatography, Ion exchange chromatography, Gel Permeation chromatography.

UNIT V

Basic concept of radioactivity and measurement of radioactivity. Radioisotope techniques – GM Counter, Liquid scintillation and Solid scintillation counter, fluorimetry and its types. Physical Biomedical method of Imaging techniques, Intact biological structures (X-ray, CAT-SCAN, ECG, EEG, NMR) Autoradiography, X ray crystallography.

REFERENCES

1. Biochemistry (1995) Voet, D. & Voet, J.G. 2nd Edi. John Wiley & Sons.
2. Bioinstrumentation (2004) John Webster. John Wiley & Sons.
3. Bioinstrumentation (2006) Veerakumari, 1st Edi. MJP Publishers.
4. Molecular Biology of the Gene. (1987). James, D. Watson. Hopkins, N.H, Roberts.
5. Biochemistry. (1993). Zubay.G.L, 4th Edi. WmC.Brown Publishers.
6. A Biologist guide to principles and techniques of practical biochemistry.(1975). Bryan, W. & Keith, W.
7. Practical Biochemistry (1995) Wilson, K. & Walker, J. 5th Edi. Cambridge University Press.

ELECTIVE – I -SOIL SCIENCE- M16PBTE02

UNIT I

Definition and composition of soil, Soil as three phase system (solid, liquid and gas), Soil texture, Influence of soil texture on soil properties, Various methods of estimation of soil texture. Classification according to various systems, Soil mineralogical composition.

UNIT II

Clay and its classification, Soil Structure and soil aggregation, Classification of soil structure. Factors influencing soil structures and plant growth. Bulk density, Particle density and Porosity. Factors Influencing Bulk density, Particle density and Porosity.

UNIT III

Soil consistency, Cohesion, Adhesion. Forms of consistency, Factor influencing soil consistency, Plasticity. Soil moisture, Forms of soil water. Water – energy concept, Soil moisture potential.

UNIT IV

Water flow in saturated and unsaturated soil. Infiltration, Redistribution, Evaporation, Water balance in field. Soil Moisture Characteristic Curve. Hysteresis. Soil water movement. Saturated Flow, Unsaturated Flow,

UNIT V

Soil air and its composition, Significance. Factor Influencing Soil Air Composition. Effect of soil aeration on plant growth. Soil temperature and its importance, Thermal properties of soil. Factors influencing soil temperature. Effect of soil temperature on soil properties and on plant growth.

REFERENES

1. Baver, L. D., Gardner, W. H. and Gardna, W. R. 1972. Soil Physics. John Wiley, New York.
2. Oswal, M. C. 1994. Soil Physics –Oxford IBH, New Delhi.
3. Hanks and Ascheroft. 1980. Applied Soil Physics. Springer– Verlag, Berlin.
4. Hillel, D. 1998. Environmental Soil Physics. Academic Press, New York.
5. Hillel, D. 1982. Introduction to Soil Physics. Academic Press, New York.
6. Hillel, D. 1980. Application of Soil Physics. Academic Press, New York.
7. Khanke, H. 1968. Soil Physics. McGraw Hill Publishing Co., New Delhi.
8. Kirkham, D. and Powers, W. L. 1972. Advanced Soil Physics. Wiley Interscience.
9. Ghildyal, B. P., K. P. Tripathi. 1987. Soil Physics. Wiley Eastern Limited, New Delhi.

ELECTIVE – I - HUMAN PHYSIOLOGY – M16PBTE03

UNIT I

Blood- Composition and functions of plasma, hemopoiesis, erythrocytes including Hb, leukocytes and thrombocytes, plasma proteins and their role. Blood coagulation – mechanism and regulation, Fibrinolysis, Blood groups and Rh factor. Transfers of blood gases -oxygen and carbon dioxide. Role of 2, 3-BPG, Bohr effect and chloride shift. Regulation of respiration, Pulmonary circulation.

UNIT II

Digestive system- Composition, functions and regulation of salivary, gastric, pancreatic, intestinal and bile secretions. Digestion and absorption of carbohydrates, lipids, proteins, nucleic acids, minerals and vitamins. Role of peristalsis and large intestine in digestion.

UNIT III

Resting potentials and action potentials of excitable cells, contraction of skeletal, cardiac and smooth muscles. Neurophysiology: Types of neurons and synapses and transmission of nerve impulse across them, Neurochemistry of vision, gustation, olfaction and hearing. Sensory receptors in skin and muscles. Endocrinology- Secretion, mechanisms of action and effects of hormones of hypothalamus, pituitary, thyroid, adrenal gland and pancreas. Synthesis and functions of testosterone and ovarian hormones.

UNIT IV

Rhythmical excitation of heart, basic theory of circulatory function, blood flow and resistance, function of arterial and venous systems Microcirculation and lymphatic system, control of blood flow, regulation of arterial pressure, cardiac output. Spinal cord and motor functions, role of brain stems in controlling motor functions, functions of cerebellum, functions of cortical areas, the limbic system and cerebrospinal fluid system.

UNIT V

Excretory system- Structure of nephron, formation of urine (glomerular filtration, tubular reabsorption of glucose, water and electrolytes), tubular secretion, role of kidneys regulation of blood pressure. Control of body temperature, effect of low oxygen pressure on body, effects of acceleratory forces on body, effects of high partial pressures of gases on body

REFERENCES

1. Textbook of Medical Physiology 10th Ed By Arthur C. Guyton and John E. Hall, Harcourt Asia Pte Ltd.
2. Essential Medical Physiology 3rd Ed By Leonard R. Johnson, Elsevier Academic Press.
3. Endocrinology: An Integrated Approach By SS Nussey and SA Whitehead. BIOS Scientific Publishers
4. Physiology 3rd Ed, By Linda Costanzo, Saunders Publishers.
5. Principles of Anatomy and Physiology 10th Edition By Gerard J. Tortora and Sandra Grabowski. Publisher: John Wiley and Sons.
6. Principles of Human Physiology (Paperback) By Cindy L. Stanfield and William J. Germann. Publisher: Pearson Education.
7. Samson Wright's Applied Physiology 13th Ed. CA Keele, E Neil & N Joels. Oxford University Press.
8. Principles of Biochemistry: Mammalian Biochemistry By Emil Smith. McGraw Hill Publications.
9. Human Physiology: The Mechanisms of Body Function (Paperback) By Arthur J. Vander, James Sherman, Dorothy S. Luciano, Eric P. Widmaier, Hershel Raff and Hershel Strang. McGraw Hill Education.
10. Medical Physiology: Principles for Clinical Medicine 3rd Ed. By Rodney R. Rhoades and David R. Bell. Lippincott Williams & Wilkins.

ELECTIVE – I – HORTICULTURE - M16PBTE04

UNIT I

Horticulture :- Importance and scope of Horticulture, Classification of horticultural crops – fruits, vegetables crops, climate, soil, water, nutrition needs of horticultural crops,

UNIT II

Plant propagation methods, cutting, layering, grafting, budding, stock-seion relationship. Use of plant regulators in horticulture.

UNIT III

Garden designs, types of gardens – formal, informal and kitchen garden, units of garden, hedge, border, popiary arches and lawn maintenance.

UNIT IV

Floriculture, cultivation of commercial flowers – rose and jasmines. Cultivation of important fruit trees – Mangoes and Banana.

UNIT V

Green house, Indoor gardening – Bonsai – flower arrangements – nursery management and maintenance

REFERENCES

1. Bose, T.K. & Mukherjee, D. (1972) : Gardening in India, Oxford & IBH Publishing Co., Kolkatta, Mumbai, New Delhi-385pp.,
2. Sandhu, M.K. (1989) : plant Propagation Wiley Eastern Ltd.,New Delhi, Bangalore, Bombay, Calcutta, Madras, Hyderabad, Pune-287pp.,
3. Lex Lauries & Victor H. Rice- (1950) : Floriculture – fundamental and practices. McGraw Hill Publishers, N.Y.
4. Kumar , N. (1997) : Introduction to Horticulture Rajalakshmi Publications, Nagercoil, India- (28 Chapters & approx. 300pages)
5. Naik South Indian Fruits and their culture Vardhachary & Co., Madras.
6. Edmond Musser & Andres () : Fundamentals of Horticulture McGraw Hill Book Co.,
7. Gardener : Basic Horticulture Mac Millan, N.Y.
8. Randhawa : Ornamental Horticulture in India Today & Tomorrow Publishers, New Delhi

PRACTICAL – I- LAB IN CELL BIOLOGY AND BIOLOGICAL CHEMISTRY – M16PBTP01

CELL BIOLOGY

1. Principles of Microscopy and optics
2. Measurement of Cell size by Micrometry
3. Preparation of permanent slides – DPX mount
4. Mitosis and Meiosis
5. Giant Chromosomes (Polytene-Chironomous larvae)
6. Sex Chromatin (Barr Body)
7. Blood cells identification
8. Microtomy - Demo

BIOMOLECULES

1. Preparation of Buffers
2. Calibration of P^H meter
3. Verification of Berr Lambert's Law
4. Estimation of glucose (DNS method)
5. Estimation of DNA (Diphenylamine)
6. Estimation of RNA (Orcinol)
7. Estimation of Protein (Lowry's and Bradford Methods)
8. Extraction and Estimation of starch from potato/ tapioca
9. Separation of aminoacids by Paper and Thin layer chromatography
10. Qualitative analysis of carbohydrate
11. Qualitative analysis of aminoacids.
12. Native PAGE and SDS-PAGE

PRACTICAL – II- LAB IN MICROBIOLOGY AND MOLECULAR BIOLOGY- M16PBTP02

MICROBIOLOGY

1. Safety guidelines in laboratory practices.
2. Preparation of washing solution.
3. Handling of Microscopes
4. Sterilization Techniques – Physical and chemical methods.
5. Preparation of broth and agar media
6. Maintenance of Microorganisms
7. Staining methods – Simple staining, differential staining, special staining, and LCB mount.
8. Motility of bacteria by hanging drop method.
9. Biochemical characterization of Bacteria – Catalase test, oxidase test, Sugar fermentation, IMVIC, urease test, TSI test, Starch hydrolysis.
10. Cultural characteristics of microorganisms on Basal medium, Selective medium, Differential medium, Enriched medium, Enrichment medium.
11. Isolation and pure culture of microorganisms from soil and water - Serial dilution methods, Plating, Streaking.
12. Growth - Growth curve, Measurement of bacterial population by turbidometry, haemocytometry and serial dilution methods.
13. Antibiotic sensitivity test by Kirby- Bauer disc diffusion method.
14. Determination of potability of water by MPN method.

MOLECULAR BIOLOGY

1. Single Cell Colony isolation – Checking for antibiotic resistant Markers.
2. Induced Mutagenesis (UV, NTG & EMS).
3. Isolation of antibiotic resistant Bacteria by gradient plate technique.
4. Detection of mutants by replica plate technique.
5. Study of Mutation by Ames test.

SEMESTER - II

Part	Paper Code	Title of the Paper	Credits	Lecture Hrs/Wk	Int. Marks	Ext. Marks
Core V	M16PBT05	Genetic Engineering & rDNA Technology	4	4	25	75
Core VI	M16PBT06	Immunology	4	4	25	75
Core VII	M16PBT07	Bioprocess Technology	4	4	25	75
Elective		Elective	3	4	25	75
EDC		EDC	4	4	25	75
Core Practical-III	M16PBTP03	Lab in Genetic engineering and rDNA technology	4	4	40	60
Core Practical-IV	M16PBTP04	Lab in Immunology and Bioprocess technology	4	4	40	60
Part- IV	M16PHR01	Human Rights	2	2	25	75
			29			

GENETIC ENGINEERING AND rDNA TECHNOLOGY – M16PBT05

UNIT I

Manipulation of DNA- Restriction and modification enzymes: Restriction enzymes, Ligases, Alkaline phosphatase, Polynucleotide kinase, Terminal nucleotidyl transferase, DNA Polymerases, Taq DNA polymerases, RNase, Reverse transcriptase. Linkers, Adaptors, Oligonucleotide primers & Homopolymer tailing.

UNIT II

Gene cloning vectors- Plasmids, Construction of pBR322, Bacteriophages vectors, phagemids, cosmids, Yeast vectors and Expression vectors in Prokaryotic and Eukaryotic, Ti plasmids, Vector NTI database,

UNIT III

DNA sequencing techniques- Maxam Gilbert method, Sanger's method, Next generation sequencing, DNA Amplification- PCR and its types, RFLP, RAPD, SAGE, Site-directed Mutagenesis, Molecular beacons, DNA hybridization and blotting techniques, Microarrays.

UNIT IV

Cloning strategies- Gene Library construction, Screening of gene library, Expression strategies for heterologous genes- expression in bacteria, yeast, insects and insect cell lines, mammalian cell lines and in plants. Processing of recombinant proteins-Purification and refolding, characterization of recombinant proteins, stabilization of proteins.

UNIT V

Transposon tagging- Role of gene tagging in gene analysis. Gene Knock in and out technologies, Transgenic animals (Mice, Cattle, Fish), Transgenic plants(Herbicide tolerance, Delayed ripening) Antisense RNA technology, Human Gene Therapy, Ethics and Philosophies in rDNA.

REFERENCES

1. Mickloss D.A and G.A.Greyer (1990) DNA Science - A First Course in Recombinant Technology, Cold Spring Harbor Laboratory Press, New York.
2. Primrose, S.B (1994) Molecular biotechnology (2nd Edi). Blackwell Scientific Publishers, Oxford.

3. Davis J.A. and W.S.Roznikolf (1992) Milestones in Biotechnology. Classic papers on genetic Engineering, Butterworth-Helnemann, Boston.
4. Walker M.R. and R.Repley (1997) Route Maps in Gene Technology Blackwell Science Ltd., Oxford.
5. Kingsman S.M. and A.J.Kingsman, (1998) Genetic Engineering. An Introduction to gene analysis and exploitation in eukaryotes. Blackwell Scientific Publications, Oxford.
6. James D. Watson. Recombinant DNA (2001). Scientific American Books. USA
7. Glick, B Pasternak, J.J (2007) Molecular Biotechnology. ASM Press, Washington.
8. Benjamin Lewin. Genes-VIII. Oxford University Press.
9. Glover, D.M and B.D Hames. DNA cloning 1-4(2006) Oxford University Press.
10. Mark Schena (2002) Microarray Analysis. 1st Edition. John Wiley & Sons Ltd.

IMMUNOLOGY - M16PBT06

UNIT I

History and scope of immunology, Host - Parasite relationship, Infection – types – mode of transmission , Immunity – types- mechanisms, Haematopoiesis-lymphoid cells – myeloid cells and their maturation .Organs of the immune system- primary and secondary lymphoid organs – structure and functions.

UNIT II

Antigen – properties- classes, haptens, mitogens, adjuvants, epitopes. Immunoglobulin- basic structure, classes, function, molecular diversity of immunoglobulins. Immune responses- generation of immune response-humoral immune response - cell mediated immune response- recognition of antigen by humoral branch (B cells) and cell mediated branch (T cells).Generation of lymphocyte specificity and diversity, clonal selection of lymphocytes.

UNIT III

Antigen – Antibody reactions. Complements- components, properties, activation pathways-alternative, classical, lectin. Cytokines – properties structure and functions. Major histocompatibility complex –general organization and inheritance of MHC, structure – function- role in antigen processing and presentation. Immunological tolerance.

UNIT IV

Hypersensitivity – types, mechanisms, manifestations. Transplantation – classification, transplantation antigens, graft acceptance, rejection, process of graft rejection, immuno suppressive therapy, Molecular aspects of HLA typing. Autoimmunity- mechanism of auto immunization- types. Immunodeficiency diseases. Tumor immunology.

UNIT V

Antigen-isolation and purification from pathogenic bacteria. Antibody production- Hybridoma technology and engineered monoclonal antibodies. Purification of antibodies. Isolation of macrophages. Macrophage culture. Immuno screening of recombinant library. Detection of immune complex in tissues. FACS. Delayed type hypersensitivity assessment – Mantoux test. Molecular aspects of HLA typing. Recent strategies of vaccines production and immunization schedule.

REFERENCES

1. Rajasekara Pandian M and Senthilkumar B (2007) Immunology and Immunotechnology. Panima Publishing Corporation , New Delhi.
2. Goldsby RA, Kindt TJ,Osborne BA, Kuby J (2003) Immunology 6th Edn. WH Freeman &Co. New York.
3. Kuby J (1997) Immunology 3rd Edn .WH Freeman &Co. New York.
4. Benjamini E, Coico R and Sunshine G (2000). Immunology .4th Edn. A John Wiley & sons, Inc. Publication.
5. Roitt I,Brostoff J and Male D (1993). Immunology 3rd Edn. Mosby.
6. Pelczar MJ, Chan ECS and Krieg NR. Microbiology (2006) 5th Edn. Tata McGraw-Hill Publishing Company Ltd.New Delhi.
7. Tizard IR (1995).Immunology 4th Edn. Saunders College Publishing Harcourt Brace College Publishers.
8. Talwar GP and Guptha (2004). A hand book of practical immunology .2nd Edn. VolIII.CBSPublications.

BIOPROCESS TECHNOLOGY - M16PBT07

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. Basic principles in bioprocess. Fermentations – submerged, solid state and immobilization.

UNIT II

Media formulation. Sterilization. Thermal death kinetics. Batch and continuous sterilization systems, Sterilization of air. Fibrous filters. Reactor dynamics and stability, non ideal reactor, residence time distribution, mixing pattern, types of reactors – CSTR, Tower, jet loop, Air lift, bubble column, packed bed, Immobilized cells. Enzyme co-immobilization. Bioreactor design, parts and their functions.

UNIT III

Transport phenomenon in bioprocess – Mass transfer, Mass transfer 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. Heat transfer coefficients.

UNIT IV

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

UNIT V

Ultrafiltration centrifugation, Chromatography, Electrophoresis, Solvent extraction, Distillation, purification of biologicals (Down stream processing).

REFERENCES

1. Principles of Fermentation Technology. Peter F. Stanbury. Butterworth-Heinemann, Elsevier Science Ltd.
2. Biotechnology: A Text Book of Industrial Microbiology, Wulf Crueger and Anneliese Crueger. Science Tech Publishers. USA.
3. Fermentation Biotechnology. Jayanto Achrekar. 2006. Dominant Publishers and Distributors. New Delhi.
4. Separation Process in Biotechnology. Juan.A.Asenjo. 2007. Taylor & Francis group.

**ELECTIVE – II - STEM CELL BIOLOGY AND TISSUE ENGINEERING -
M16PBTE05**

UNIT-I

Stem Cells – Basics, Properties and Classification, Types of Stem cells – Hematopoietic Stem Cells, Mesenchymal Stem Cells, Embryonic Stem Cells, Fetal Stem Cells, Adult Stem cells and their Characteristics.

UNIT-II

Pluripotency, niche specification – Drosophila germ line stem cells, self renewal and differentiation, Characteristics of stem cell – Cell cycle, Ras/Raf pathway, PI3 cell signaling, p53 check points, role of LIF pathway in cell cycle control.

UNIT-III

Hypoxic condition and gene expression (pre implantation stage), stem cell communications – gap junctions, cell fusion, HOX genes, upstream transcriptional factors, embryonic genes. Stem Cells in Gastrointestinal , Liver, Pancreas, Kidney, Heart, Spinal Cord and Lung Regeneration ,Stem Cells in Eye Diseases and Disorders

UNIT-IV

Morphogenesis and Tissue Engineering, Principles of Tissue Culture, Bioreactor Design, Mechanochemical Regulation of Cell Behaviour, In Vitro and In Vivo Synthesis of Tissues and Organs, Micro-Scale Patterning of Cells and their Environment, Three-Dimensional Scaffolds,

UNIT-V

Tissue Engineering and Transplantation Techniques, Immunoisolation Techniques, Modes of Cell and Tissue Delivery, Regeneration of Bone and Cartilage, Islet Cell transplantation and Bioartificial Pancreas, Bioprinting of Organs and Tissues.

REFERENCES

1. R. Lanza, J. Gearhart et al (Eds), Essential of Stem Cell Biology. (2009), Elsevier Academic press.
2. R. Lanza and I. Klimanskaya, Essential Stem Cells Methods. (2009), Academic Press
3. J. J. Mao, G. Vunjak-Novakovic et al (Ed): Translational Approaches in Tissue Engineering & Regenerative Medicine 2008, Artech House, INC Publications.
4. Robert Lanza et al. Principles of Tissue Engineering, 3rd Edition. Academic Press; 3 edition (August 21, 2007)

5. Stein et al. Human Stem Cell Technology and Biology: A Research Guide and Laboratory Manual. Wiley-Blackwell; 1 edition (January 4, 2011)
6. Lanza et al. Handbook of Stem Cells, Two-Volume Set: Volume 1-Embryonic Stem Cells; Volume 2-Adult & Fetal Stem Cells (v. 1). Academic Press (September 28, 2004)

ELECTIVE – II- INDUSTRIAL SAFETY - M16PBTE06

UNIT I

Site selection, plant layout- design for ventilation - basic rules and requirements which govern the chemical industries – social environmental setup – tolerance limit of the society.

UNIT II

Chemical hazards classification – hazards due to fire and explosion – safety analysis – chemical and job safety – safe handling and operation of materials and machineries.

UNIT III

Types of hazard analysis – hazard identification – HAZOP – hazard survey – Fault tree analysis - event tree analysis.

UNIT IV

Effective steps to implement safety procedure – periodic advice and constant maintenance – personal protective equipments- types – fire fighting equipments.

UNIT V

Introduction – biosafety issues in Biotechnology – Historical background – primary contaminants for biohazards biosafet guidelines and regulations (National and International) – operation of Biosafety guidelines and regulation of Government of India – Risk analysis – risk assessment – risk management.

REFERENCES

1. Fawcett H.H. and Wood W.S. Safety and Hazard prevention in chemical operation, Intersciences, 1965.
2. Blake R.P. Industrial safety Prentice Hall Inc. New Jersey, 2nd Edition, 1963.

ELECTIVE - II - CLINICAL BIOCHEMISTRY - M16PBTE07

UNIT 1

Disorders of carbohydrate metabolism: Diabetes mellitus, glycohemoglobins, hypoglycemias, galactosemia and ketone bodies. Various types of glucose tolerance tests. Glycogen storage diseases. Physiology of lipids/lipoproteins. Lipidosis. Clinical interrelationships of lipids (sphingolipidosis and multiple sclerosis), lipoproteins and apolipoproteins. Diagnostic tests for HDL-cholesterol, LDL-cholesterol and triglyceride disorders. Inborn errors of metabolism:

UNIT-II

Disorders of amino acid metabolism- Phenylalanemia, homocystinuria, tyrosinemia, MSUD, phenylketonuria, alkaptonuria, albinism and aminoacidurias. Disorders of nucleic acid metabolism- Disorders in purine/ pyrimidine metabolism.

UNIT III

Electrolytes, blood gases, respiration and acid-base balance. Disorders of acid-base balance and their respiratory and renal mechanisms. Evaluation of organ function tests: Assessment and clinical manifestations of renal, hepatic, pancreatic, gastric and intestinal functions. Clinical importance of bilirubin. Diagnostic enzymes: Principles of diagnostic enzymology. Clinical significance of aspartate aminotransferase, alanine aminotransferase, creatine kinase, aldolase and lactate dehydrogenase. Enzyme tests in determination of myocardial infarction. Enzymes of pancreatic origin and biliary tract.

UNIT IV

Hormonal disturbances: Protein hormones (anterior pituitary hormones, posterior pituitary hormones), steroid hormones, adrenocorticosteroids, and reproductive endocrinology. Disturbances in thyroid function. Disorders of mineral metabolism: Hypercalcaemia, hypocalcaemia, normocalcaemia, hypophosphataemia and hyperphosphataemia.

UNIT V

Biochemical aspects of hematology: Disorders of erythrocyte metabolism, hemoglobinopathies, thalassemias thrombosis and anemias. Laboratory tests to measure coagulation and thrombolysis. Detoxification in the body: enzymes of detoxification, polymorphism in drug metabolizing enzymes. Mechanism of drug action and channels of its excretion, Disorders of vitamins and trace elements.

REFERENCES

1. Textbook of Medical Biochemistry By MN Chatterjea and Rana Shinde, Jaypee Brothers.
2. Lehninger Principles of Biochemistry 5th Ed By David L. Nelson and Michael M. Cox, WH Freeman and Company.
3. Davidson's Principles and Practice of Medicine: A Textbook for Students and Doctors (Hardcover) 15th Ed By LSP Davidson, J MacLeod and CRW Edwards. Publisher: Churchill Livingstone.
4. Medical Biochemistry (Paperback) By John W. Baynes and Marek Dominiczak. Publisher: Mosby.
5. Clinical Biochemistry: An Illustrated Colour Text (Paperback) 3rd Ed By Allan Gaw, Michael Murphy, Robert Cowan, Denis O'Reilly, Michael Stewart and James Shepherd. Publisher: Churchill Livingstone.
6. Review of Medical Physiology (Lange Basic Science) (Paperback) By William F. Ganong. Publisher: McGraw-Hill Medical.
7. Harper's Biochemistry (Lange Medical Books) (Paperback) By Robert K. Murray, Daryl K. Granner, Peter A. Mayes and Victor W. Rodwell. Publisher: Appelton and Lange.
8. Clinical Biochemistry By Richard Luxton. Scion Publishing Ltd.
9. Principles of Medical Biochemistry: With STUDENT CONSULT Online Access (Paperback) By Gerhard Meisenberg and William H. Simmons. Publisher: Mosby.

ELECTIVE – II -AQUACULTURE - M16PBTE08

UNIT – I

Importance of aquaculture – over - exploitation of wild fish stocks – advantages of aquaculture – production trends in the world and in India. Scope for aquaculture in India. Basic Fish farm design : selection of site, grow - out and nursery ponds.

UNIT – II

Cultivable species of fish, crustaceans, molluscs and algae. Selection of candidate species for aquaculture. Types of farming: extensive, intensive and semiintensive culture. Integrated farming. Advantages of polyculture, monosex and monoculture.

UNIT – III

Culture of carp species –oyster culture: pearl oyster. Prawn culture: the problems in penaeid prawn culture due to socio-economic and environmental problems. Freshwater prawn culture. Potential for ornamental fish culture. Common species for ornamental fish farming.

UNIT – IV

Fish disease management: Common bacterial, viral, fungal, protozoan and crustacean diseases, their symptoms and treatment. Water quality maintenance. Importance and composition of feeds; types of feed: wet and dry feeds.

UNIT – V

Marketing the products: Marketing the fish to local markets and for export. Harvesting and transport. Quality control and norms of MPEDA for export of fishes. canning and freezing.

REFERENCES

1. Arumugam, N. 2008. Aquaculture Saras Publications, Nagercoil.
2. Rath, R.K. (2000) Freshwater Aquaculture. Scientific Publishers, (India), PO. Box.91, Jodhpur.
2. Jhingran, AVG (1991) Fish and Fisheries of India. Hindustan Publishing Co.
3. Baradach, JE, JH Ryther and WO Mc Larney (1972) Aquaculture. The farming and Husbandry of Freshwater and Marine Organisms. Wiley Interscience, New York.

PRACTICAL - III - LAB IN GENETIC ENGINEERING AND rDNA TECHNOLOGY
- M16PBTP03

1. Agarose gel electrophoresis
2. Selection of genetic marker – IPTG-X-Gal, GUS assay
3. Isolation of genomic DNA & Detection in AGE
4. Isolation of plasmid DNA & Detection in AGE
5. Screening of Bacteriophages.
6. Isolation of Auxotrophic mutants – Replica plate
7. Isolation of Lambda phage DNA
8. Quantification of Nucleic acid by UV spectrophotometer.
9. Quantification of protein by SDS-PAGE
10. Bacterial Transformation.
11. Bacterial Conjugation – Uninterrupted & Interrupted
12. Restriction digestion
13. Ligation
14. Determination of molecular weight of Nucleic acids by Gel Doc.
15. Amplification of DNA - PCR.
16. RFLP and RAPD (Demo)

PRACTICAL – IV- LAB IN IMMUNOLOGY AND BIOPROCESS TECHNOLOGY - M16PBTP04

IMMUNOLOGY

1. Differential count of white blood cells
2. Preparation of serum & plasma
3. ABO Blood grouping
4. Widal test for typhoid fever (qualitative and quantitative test)
5. Anti - Streptolysin O (ASO) test
6. Rheumatoid arthritis (RA) test
7. Pregnancy test – Detection of HCG
8. Rapid Plasma Regain Test (RPR)
9. Ouchterlony's Double Immunodiffusion Technique (ODD)
10. Counter Current Immunoelectrophoresis (CIE)
11. Immuno Electrophoresis (IE)
12. Radial Immuno Diffusion (RID)
13. Rocket Immuno Electrophoresis (RIE)
14. Raising of antiserum in laboratory animals
15. Antibody purification by column chromatography
16. ELISA
17. Western blott -Demonstration

BIOPROCESS TECHNOLOGY

1. Isolation of Amylase and protease producing organisms from soil.
2. Isolation of antibiotic producing microbes from soil.
3. Culture optimization (pH, Temperature, Carbon & Nitrogen sources).
4. Production and assay of amylase and protease by submerged fermentation .
5. Production and assay of amylase and protease by solid-state fermentation.
6. Bioassay of Antibiotics.
7. Microbial production of citric acid using *Aspergillus niger*.
8. Immobilization of cells for enzyme production.
9. Alcohol production by yeast fermentation and its estimation.
10. Purification of enzymes by salting and dialysis and column chromatography techniques.

SEMESTER - III

Part	Paper Code	Title of the Paper	Credits	Lecture Hrs/Wk	Int. Marks	Ext. Marks
Core VIII	M16PBT08	Plant Biotechnology	4	4	25	75
Core IX	M16PBT09	Animal Biotechnology	4	4	25	75
Core X	M16PBT10	Environmental Biotechnology & Nanotechnology	4	4	25	75
Core XI	M16PBT11	Proteomics & Genomics	4	4	25	75
Elective		Elective	3	4	25	75
Core Practical-V	M16PBTP05	Lab in plant & Animal Biotechnology	4	5	40	60
Core Practical-VI	M16PBTP06	Lab in Environmental Biotechnology, Proteomics and Genomics	4	5	40	60
			27			

PLANT BIOTECHNOLOGY - M16PBT08

UNIT I

History of plant tissue culture - Laboratory organization -Nutritional requirements of plant tissue culture. Media preparation –Types of media – MS media, Nitshs media, whites media, Gamborgs media – Plant growth regulators. Plant tissue culture-principles. The concept of totipotency of cells.

UNIT II

Sterilization techniques; Plant micro propagation – micro grafting – advantages – virus elimination by culturing of meristem and shoot tip cultures;, Establishment and maintenance of callus and suspension cultures. Somatic embryogenesis - Synthetic seeds.

UNIT III

Haploid plant production, triploid production, Anther and microspore culture, embryo culture and embryo rescue. Invitro pollination and fertilization. Protoplast isolation – fusion - Culture regeneration - somatic hybrids - cybrids. Somaclonal and Gametoclonal variation, Secondary metabolites,

UNIT IV

Gene transfer techniques in plants. Transgenic plants for insect resistance, fungus resistance, virus resistance, drought, cold and saline resistance. Molecular biology of plant pathogen interactions. Terminator seed concept .

UNIT V

Role of RFLP in Plant breeding, current status of plant transformation technologies. Production of therapeutic antibodies in plants. Edible vaccines from plants, Cryopreservation, Role of tissue culture in agriculture, forestry. Cryopreservation and germplasm conservation.

REFERENCES

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 Cukture 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. Guptha: Elements of Biotechnology. Rastogi and Co. Meerut,1996.
6. U.Satyanarayanan. Biotechnology, Books and allied (p) Ltd., 2005.
7. S.S. Bhojwani and M.K.razdan, Tissue Culture Theory and Practice, 2004.

ANIMAL BIOTECHNOLOGY - M16PBT09

UNIT - I

Gametogenesis and fertilization in animals, Molecular events during fertilization, Artificial Fertilization methods (IVF, IUF, ICSI) and embryo transfer, Superovulation, Polycystic ovarian syndrome (PCOS), Collection and preservation of embryo, culture of embryos, culture of embryonic stem cells and its applications.

UNIT - II

Fundamentals. Facilities and Applications. Media preparation for Animal cells culture. Types of cell culture: Primary and secondary cell culture, cell transformation, cell lines, stem cell culture. Tests: cell viability and cytotoxicity, cell synchronization, senescence and apoptosis. Organ culture and transplantation, Cryopreservation.

UNIT - III

GMO (Genetically modified organism), methods of DNA transfer into animal cells - calcium phosphate co precipitation, micro-injection, electro oration, Liposome encapsulation. Hybridoma technology, Vaccine production.

UNIT - IV

Mapping of human genome, Human Genome Project (HGP). RFLP, RAPD and its applications. Gene silencing, DNA finger printing and Forensic Science. Molecular diagnosis of Genetic disorders.

UNIT - V

Transgenic animals. Production and recovery of products from animal tissue cultures: cytokines, Plasminogen activators, Blood clotting factors, Growth hormones, inslulin Transgenic animals – Merits and demerits -Ethical issues in animal biotechnology.

REFERENCES

1. Freshney, E. D. 2000. Animal Cell Culture: A practical approach. John Wiley Pub. New York.
2. Mather, J.P. and Barnes, D. (Eds.). 1998. Animal Cell Culture Methods (Methods in Cell Biology. Vol. 57). Academic Press, London.
3. Butler, M. (Ed.). 1990. Mammalian Cell Biotechnology - A Practical Approach. Oxford Univ. Press, Oxford.
4. Singer, M. and P. Berg. (Ed.). 1997. Exploring Genetic Mechanisms. University Science Books, Sausilato, CA, USA.

5. E.J. Murray (Ed). 1991. Gene Transfer and Expression Protocols – Methods in Molecular Biology Vol.7. Humana Press, Totowa, NJ.
6. Watson, J.D., N.H.Hopkins, T.W.Roberts, J.A.Steitz and A.M. Weiner. 1987. Molecular Biology of Gene. Benjamin Cummins, San Francisco.
7. Watson, J.D., M. Gilman, J. Witkouski and M.Zoller. 1992. Recombinant DNA. Scientific American Books, New York.
8. Puller, A. (Ed). 1993. Genetic Engineering of Animals. VCH Publishers, New York.
9. Balinsky, B.I. 1975. An Introduction to Embryology. Saunders, Philadelphia.
10. Beril, N.J. 1974. Developmental Biology. Tata McGraw -Hill Publishing Company Ltd. New Delhi.
11. B Singh, SK Gautam and MS Chauhan. 2013. Textbook of Animal biotechnology. The Energy and Research Institute.
12. M.K. Sateesh. 2010. Biotechnology: V: (Including Animal Cell Biotechnology, Immunology and Plant Biotechnology). 2nd Edition. New Age International.

**ENVIRONMENT BIOTECHNOLOGY AND NANOTECHNOLOGY -
M16PBT10**

UNIT – I

Introduction, types, Measurement of air pollution. Global environmental problems in atmosphere - ozone depletion, green house effect and acid rain.

UNIT – II

Introduction, types, sources of water pollution. Biomonitoring of water pollution using algae, bacteria, plankton, macrophytes, invertebrates, fishes (Bioindicators). Waste water treatment - physical, chemical and biological treatment processes. Biotechnological approaches for industrial waste water treatment - dairy, distillery, tannery, sugar, and pharmaceutical industries. Bioremediation of oil spills.

UNIT – III

Introduction, types of solid wastes. Biodegradation of inorganic and organic wastes, lignin, tannin. Solid waste disposal - land filling, incineration, composting, mushroom farming, vermiculture and biogas production. Processing of sugar factory wastes, residential and municipal wastes, coir wastes and sago wastes. Biodegradation of xenobiotics.

UNIT – IV

Definition of a nano system - dimensionality and size dependent phenomena, Quantum dots, Nanowires and Nanotubes, 2D films. Methods for synthesis of Nanoscale Materials.. Basic concepts and properties of nanostructured materials. Gold Nanoparticles. Nanopores. Characterisation of Nanomaterials.

UNIT - V

Nanosensors - types and its applications. Nanocarriers for Drug Delivery - Polymeric Nanoparticles as Drug Carriers. Micelles for Drug Delivery. Micro-array and Genome Chips. Microemulsions as Drug Delivery Vehicles, Lipoproteins as Pharmaceutical Carriers. Solid Lipid Nanoparticles as Drug Carriers. Nanocapsules – preparation, characterization and Applications.

REFERENCES

1. Alan Scragg. 1999. Environmental Biotechnology. Pearson Education Limited, England.
2. De, A.K. 2004. Environmental Chemistry. Wiley Eastern Ltd. New Delhi.

3. Allsopp, D. and K.J. Seal. 1986. Introduction to Biodeterioration. ELBS/Edward Arnold, London.
4. Ratner, M. and Ratner, D. 2005. Nanotechnology: A Gentle Introduction to the Next Big idea. Pearson Education, Inc. NJ, USA.
5. Christef M. Niemeyer, C. A. Mirkin. 2004. Nanobiotechnology: Concepts, Application and Properties. Wiley – VCH Publishers, New York.
6. Tuan Vo-Dinh. 2007. Nanotechnology in Biology and Medicine: Methods, Devices and Applications. Taylor and Francis Inc., London.
7. Pradeep, T. 2006. NANO. Tata McGraw Publishers, New Delhi, India
8. Challa S.S.R. Kumar (Ed). 2006. Biological pharmaceutical Nanomaterial, Wiley-VCH Verlag Gmbh & Co, KgaA. Weinham, Germany.
9. Vladimir P.Torchilin (Ed.). 2006. Nanoparticulates as Drug Carriers. Imperial College Press, North Eastern University, USA. ISBN 1-86094.
10. Jogdand, S.N. 1995. Environmental Biotechnology. 1st Edition. Himalaya Publishing House, Bombay.
11. Technoglous, G., Burton, F.L. and Stensel, H.D. 1995. Wastewater Engineering – Treatment, Disposal and Reuse. 3rd Edition. Metcalf and Eddy, Inc., Tata Mc Graw Hill, New Delhi.
12. Jain, K.K. 2006. Nanobio-Technology in Molecular Diagnostics: Current Techniques and Applications. Horizon Biosciences, India.
13. Parag Diwan and Ashish Bharadwaj. 2006. Nano Medicines Pentagon Press. ISBN 81-8274-139-4.

PROTEOMICS AND GENOMICS - M16PBT11

UNIT – I

Introduction to Genomics: Definition of Genome, Genome sequencing-chain termination method (Sanger's Method), Chemical degradation method (Maxam and Gilbert method), Short-gun sequencing, whole genome sequencing, Genome mapping: Genetic mapping- DNA markers-RFLP,SSLP, SNP-Pedigree analysis; Physical mapping- Restriction site mapping, FISH, STS; Human genome project, Map repositories: NCBI – Entrez Human genome map viewer, OMIM (Online Mendelian Inheritance in Man).

UNIT-II

Genome Annotations: Locating the Genes in a Genome Sequence, ORF Scanning, Exon-intron boundaries, cDNA hybridization, RT-PCR (Reverse transcriptase PCR), RACE (rapid amplification of cDNA ends), heterpduplex analysis, Exon trapping, Gene inactivation, Genetic footprinting, RNA interference, computational gene analysis-homologous genes-orthologous, paralogous, ORF Finder, Genscan and GenomeThreader.

UNIT – III

Functional Genomics: Transcriptomes, Transcriptome analysis, cDNA micro arrays, Raw data from microarrays, data quality, Gene expression matrices, grouping expression data, clustering methods, Feature reduction, Microarray data format, Micro array data analysis tools, gene pathway reconstruction, SAGE (Serial analysis of gene expression).

UNIT-IV

Proteomics, amino acids-peptides and proteins- life cycle of a protein, sequencing of protein-N and C terminal sequencing- proteomics- tools and application of proteomics, 3D structure of protein- overview-protein secondary, tertiary, quaternary structure- protein Denaturation-protein folding- reverse turns- Ramachandran plot- Expasy tools.

UNIT-V

Analytical proteomics-analytical protein and protein separation techniques- 1D SDS-PAGE, isoelectric focusing, 2D SDS-PAGE, image analysis of 2D gels-HPLC-protein digestion techniques. Protein identification and analysis- Mass spectrometry-tandem mass spectrometry-peptide mass finger printing- SALSA algorithm-protein arrays, Protein expression profiling, protein-protein interactions, prediction interactions based on domain fusion (yeast two hybrid system), mapping protein modifications.

REFERENCES

1. T.A.Brown (2002) Genomes, 2nd Edition, Oxford: Wiley-Liss.
2. Francisco Azuaje and Joaquin Dopazo (2005), Data analysis and visualization in genomics and proteomics, John wiley and sons, Lts.
3. Isaac S. Kohane, Alvin T Kho, Atul J.Butte (2003) Microarrays for Intergartive Genomics, The MIT Press, England.
4. D.R.Westhead, J.H.Parish and R.M.Twyman (2002), Bioinformatics, Instant notes series, BIOS Scientific Publishers ltd.
5. Daniel C Liebler (2002) **Introduction to Proteomics- Tools for the New Biology, Springer Scintific Bussiness media LLC.**
6. Twyman R.M. (2004). Principles of proteomics, York: Garland Science/Bios Scientific publishers.

BIOSTATISTICS - M16PBTE09

UNIT - I

Partial correlation - Partial correlation coefficient - Partial correlation in case of three variables - Multiple correlation.

UNIT - II

Sampling Methods - population. Sample - Concept of Sampling distributions - Standard error.

UNIT - III

Test of significance -Hypothesis - Simple hypothesis - Tests based on small samples (t-test and F-test)

UNIT - IV

Test of significance -Hypothesis - Simple hypothesis - Tests based on large samples – Single mean, difference means and single Proportion and Difference of Proportion –

UNIT - V

Chi – Square test – Assumptions and Characteristics, applications and uses – Chi – Square test for goodness of fit and independence of attributes – Simple problems.

REFERENCES

1. Dr. Pranab Kumar Banarjee. An Introduction to Biostatistics (A text book of Biometry). Revised and 4th enlarged Edition 2011,S. Chand and Company Ltd, Ram Nagar, New Delhi.
2. A.Indrayan, L. Sathyanarayana(2006).Biostatistics for Medical,Nursing and Pharmacy students. Prentice Hall of India Private Ltd, New Delhi.
3. Gupta.S.P. (2001), Statistical methods, Sultan Chand & Sons, New Delhi.
4. Pillai.R.S.N. and Bagavathi.V. (2005), Statistics, S.Chand & Company Ltd., New Delhi.

MARINE BIOTECHNOLOGY - M16PBTE10

UNIT I

World oceans and seas – ocean currents – physical and chemical properties of sea water – abiotic and biotic factors of the sea – ecological divisions of the sea – history of marine biology – biogeochemical cycles – food chain and food web.

UNIT II

Importance of Marine biological diversity: species- Phytoplanktons – zooplanktons – nektons – benthos – marine mammals – marine algae – mangroves – coral reefs – deep sea animals and adaptation.

UNIT III

Identification of Marine bioactive compounds containing organisms, sea weeds, sea grasses, sponges, mollusks, Echinoderms – associated microbes.

UNIT IV

Anticancer – antiviral – antibacterial – antifungal compounds, Biopesticides, herbicides from Marine Microbes.

UNIT V

Marine conservation: Factors creating diversity in the sea; area of diversity, area to be protected, risk factors for population and species.

REFERENCES

1. Pharmaceutical and the sea (1988) Carles W. Jerffored, Kenneth, L.Rinehart.
2. Recent advances in Marine Biotechnology, M.Fingermann, R.Nagabushanam and Mary Frances Thompson.
3. Trends in Marine Biotechnology Dr.S.Lazarus and Dr.S.G.Prakash Vincent.
4. Nutrients and Bioactive substances and aquatic organisms – K.Devadasan and M.K.Mukundan

CANCER BIOLOGY - M16PBTE11

UNIT- I

Regulation of Cell cycle, Mutations that cause changes in signal molecules, effects on receptor, signal switches, tumour suppressor genes, Modulation of cell cycle-in cancer, Different forms of cancers, Diet and cancer.

UNIT -II

Chemical Carcinogenesis, Metabolism of Carcinogenesis, Natural History of Carcinogenesis, Targets of Chemical Carcinogenesis, Principles of Physical Carcinogenesis, X-Ray radiation – Mechanism of radiation Carcinogenesis.

UNIT -III

Oncogenes, Identification of Oncogenes, Retroviruses and Oncogenes, detection of Oncogenes, Growth factor and Growth factor receptors that are Oncogenes. Oncogenes / Proto Oncogenes activity. Growth factors related to transformations.

UNIT -IV

Clinical significances of invasion, heterogeneity of metastatic phenotype, Metastatic cascade, Basement membrane disruption, Three step theory of invasion, Proteinases and tumour cell invasion.

UNIT -V

Different forms of therapy, Chemotherapy, Radiation Therapy, Detection of Cancers, Prediction of aggressiveness of Cancer, Advances in Cancer detection.

REFERENCES

1. Maly B.W.J., Virology a practical approach, IRL press, Oxford, 1987.
2. Dunmock.N.J and Primrose S.B., Introduction to modern Virology, Blackwell Scientific Publications, Oxford, 1988.
3. King R.J.B., Cancer Biology, Addison Wesley Longman Ltd, U.K., 1996.
4. Rudden.R.W., Cancer Biology, Oxford University Press, Oxford, 1995.

APICULTURE - M16PBTE12

UNIT – I

Honeybee – Systematic position – Species of Honey bees – Life history of Honey bee – behaviour – swarming – Pheromone.

UNIT – II

Bee colony – Castes – natural colonies and their yield – Types of bee hives – Structure – location, care and management.

UNIT – III

Apiary – Care and Management – Artificial bee hives – types – construction of space frames – Selection of sites – Handling – Maintenance – Instruments employed in Apiary – Extraction instruments.

UNIT – IV

Honey – Composition – uses – Bee wax and its uses – yield in national and international market – Diseases of honey bees and their control methods.

UNIT – V

Apiculture as Self - employment venture – Preparing proposals for financial assistance and funding agencies – Economics of bee culture.

REFERENCES

1. Cherian, R. & K.R. Ramanathan, 1992 – Bee keeping in India
2. Mishra, R.C., 1985 – Honey bees and their management in India, ICAR
3. Singh, S. 1982 – Bee Keeping – ICAR
4. Sharma, P. and Singh L. 1987 – Hand book of bee keeping, Controller Printing and Stationery, Chandigar.
5. Rare, S. 1998 – Introduction to bee keeping, Vikas Publishing house.
6. Shukula,G.S. and Upadhyay V.B. (1997) Economic Zoology, Rastogi Publications,Meerut

LAB IN PLANT AND ANIMAL BIOTECHNOLOGY - M16PBTP05

Plant Biotechnology

1. Preparation of media.
2. Sterilization Techniques.
3. Organ cultures.
4. Callus propagation, organogenesis, transfer of plants, hardening process.
5. Protoplast isolation.
6. Anther and pollen cultures - production of haploids.
7. Isolation of plant DNA

Animal Biotechnology

1. Preparation of tissue culture media and membrane filtration.
2. Preparation of single cell suspension from spleen and thymus.
3. Cell counting and cell viability.
4. Trypsinization of monolayer and sub-culturing.
5. Embryonated Egg inoculation.
6. Preparation of chick embryo fibroblast culture (monolayer)

**LAB IN ENVIRONMENTAL BIOTECHNOLOGY, PROTEOMICS AND
GENOMICS - M16PBTP06**

1. Determination of dissolved sulphate in water
2. Determination of iron in water
3. Determination of residual chlorine
4. Determination of silicate in water
5. Effect of heavy metal toxicity on behavioral changes in fish
6. Impact of heavy metal on oxygen consumption of fresh water fish
7. Determination of BOD in water
8. ORF-Prediction
9. Genome Annotation- GEN SCAN
10. Protein Secondary and Tertiary structure analysis- EXPASY Tools

SEMESTER - IV

Part	Paper Code	Title of the Paper	Credits	Lecture Hrs/Wk	Int. Marks	Ext. Marks
Core XII	M16PBT12	Research methodology & Research Proposal Development.	4	5	25	75
Project	M16PBTPR1	Project	4	23	25	75
Internship	M16PBTIS01	Internship	2	2	-	100
			10			

RESEARCH METHODOLOGY AND RESEARCH PROPOSAL DEVELOPMENT - M16PBT12

UNIT I

Introduction to research; Definitions and characteristics of research; Types of research; Main components of any research work. Topic Selection: Learning Objectives; Problem identification; Criteria for prioritizing problems for research.

UNIT II

Literature review: Uses of literature review; Source of information; Organization of information on index cards. Objectives: Learning Objectives; Definitions; Formulation of the research objectives.

UNIT III

Research methodologies: Study population; Variables; Sampling; Sample size determination; Plan for data collection; Methods of data collection; Plan for data processing and analysis; Ethical considerations.

UNIT IV

Work Plan; Major components and outline of the different phases in a research process; Summary of the major components of a research proposal; Fieldwork; Preparation of Research report – Thesis - dissertation -Manuscript/research article – monograph/review.

UNIT V

Measures of Mean, Median and Mode: Standard Deviation and Standard Error. Regression and Correlation coefficient analysis; Student's t-test; Analysis of Variance (ANOVA); Chi-Square test. Bioinformatics: BLAST N & P, Gene discovery using EST. Genbank Database- NCBI, EMBL & DDBJ.

REFERENCES

1. Biostatistics : A foundation for Analysis in the Health Sciences 7/E Wayne W. Daniel, Wiley Series in Probability and Statistics.
2. Prem S. Mann, 2004. Introductory Statistics. Fifth Edition. John Wiley and Sons (ASIA) Pvt. Ltd.
3. S. C. Rastogi, N. Mendiratta, and P. Rastogi. Bioinformatics Methods and Applications Genomics, Proteomics, and Drug Discovery.
4. Introduction to Bioinformatics, (Atwood, T. K. and Parry-Smith, D. J). Protein Purification by Robert Scopes, Springer Verlag Publication, 1982

5. M.Prakash, C.K.Arora , Laboratory Instrumentation,– Anmol Publications Pvt Ltd.,
6. Charles N.Relly, Donalds.T.Saweyer, Robert E.Krieger Huntington Experiments of Instrumental methods, A Laboratory Manual, New York.
7. Hoburt, H.Willard, Lynme L.Meritt J.R.John Dean, Instrumental Methods of Analysis, East West Press Pvt Ltd.