



S.N.R. SONS COLLEGE (Autonomous)

(Affiliated to Bharathiar University)
 (Re-Accredited with 'A' Grade by NAAC)
 (An ISO 9001:2008 Certified Institution)



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SCHEME OF EXAMINATION (CBCS PATTERN)

M.Sc BIOTECHNOLOGY

For the students admitted during the academic year 2015 - 2016 Batch onwards

Part	Study Components and Course Title	Instructional Hours/ Week	CIA	Comprehensive Exam	Total	Credit
Semester I						
Core	15MBT101 - Cell Biology	5	25	75	100	4
	15MBT102 - Biochemistry	5	25	75	100	4
	15MBT103 - Genetics	5	25	75	100	4
	15MBT104 - Microbiology	5	25	75	100	4
	15MBT105 - Practical I – Lab in Cell Biology and Biochemistry	5	40	60	100	3
	15MBT106 - Practical II – Lab in Microbiology	5	40	60	100	3
TOTAL					600	22
Semester II						
Core	15MBT201 - Immunology and Immunotechnology	4	25	75	100	4
	15MBT202 - Genetic Engineering	4	25	75	100	4
	15MBT203 - Molecular Biology	4	25	75	100	4
Elective	15MBT204 - Elective I	4	25	75	100	4
Core	15MBT205 - Practical III – Lab in Bioprocess and immunotechniques	5	40	60	100	3
	15MBT206 - Practical IV- Lab in Genetic Engineering	5	40	60	100	3
Supportive	Supportive course I	4	25	75	100	4
TOTAL					700	26

Semester III						
Core	15MBT301 - Plant Biotechnology	5	25	75	100	4
	15MBT302 - Animal Biotechnology	4	25	75	100	4
	15MBT303 - Bioinstrumentation and Biostatistics	5	25	75	100	4
Elective	15MBT304 - Elective - II	4	25	75	100	4
Core	15MBT305 - Practical V – Lab in Plant and Animal Biotechnology	4	40	60	100	4
	15MBT306 - Practical VI – Lab in Industrial and Environmental Biotechnology	4	40	60	100	3
Supportive	Supportive Course II	4	25	75	100	4
	IDC:	3	-	-	100*	3*
TOTAL					700	27
Semester IV						
Core	15MBT401	Project work	160@	40#	200	15
TOTAL					200	15
Total		90			2200	90

@ Project Work

Viva-voce

* Interdepartmental Course

*Not included in the CGPA

Electives: **List of Group Elective papers (Department can choose any one of the Group papers as electives)**

	GROUP A	GROUP B	GROUP C
Paper I/Sem II	Industrial Biotechnology	Food Biotechnology	Gene silencing Technology
Paper II/Sem III	Proteomics and Genomics	Agro Industrial Biotechnology	Clinical Biotechnology

List of Supportive courses (Can choose any one of the paper as Supportive paper)					
SC – I	A	Development Biology	SC – II	A	Ecology
	B	Plant physiology		B	Environmental Biotechnology
	C	Animal Physiology		C	Biosafety, Bioethics & IPR

* Interdepartmental Course : First Aid and Safety

SUMMARY

Subject	Papers	Credit	Total credits	marks	Total marks
Core	5	3	15	100	500
	11	4	44	100	1100
	1	15	15	200	200
Supportive	2	4	8	100	200
Electives	2	4	8	100	200
IDC	1	3	3*	100	100*
Total			90		2200

***Not included in CGPA**

SPLIT – UP FOR PROJECT WORK

COMPONENTS	MARKS (PROJECT WORK-CIA)
Review I,II,III	90
Execution/Implementation	10
Documentation/Thesis preparation	60
Total	160

Mark Split Up for Viva-voce

Components	Marks (VIVA-VOCE-CE)
Presentation	10
Viva-voce	30
Total	40^{\$}

\$ - Evaluated by External and Internal Examiners.

Chairman

Board of Studies- Department of biotechnology

SNR SONS COLLEGE (AUTONOMOUS)

COIMBATORE – 641 006

PROGRAMME	M.Sc BIOTECHNOLOGY
SEMESTER	ONE
SUBJECT	CELL BIOLOGY
COURSE CODE	15 MBT 101

UNIT – I

Membrane structure and function: Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, ion pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes.

UNIT - II

Structural organization and function of intracellular organelles: Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility.

UNIT - III

Cell division and cell cycle: Mitosis and meiosis, their regulation, steps in cell cycle and control of cell cycle. Microbial Physiology: Growth, yield and characteristics, strategies of cell division, stress response.

UNIT - IV

Cell signaling: Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two-component signaling systems, bacterial chemotaxis and quorum sensing.

UNIT – V

Cellular communication: Regulation of hematopoiesis, general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation. Cancer and the cell cycle

TEXT BOOKS:

1. Molecular Cell Biology, Darnell, Lodish, Baltimore, Scientific American Books. Inc., 5th edition, 1994.
2. Molecular Biology of cell, Alberts. B *et al.*, Oxford University press, 2nd edition, 2002.
3. Cell & Molecular Biology- E.D.P, De Robertis, B.I. Publications, 8th edition, 2007.

REFERENCES:

1. Molecular and cellular Biology, Stephen L.Wolfe, Wadsworth Publishing company, 1993, 1st edition.
2. Molecular Biology Lab Fax, T.A. Brown (Ed.), Bios Scientific Publishers Ltd., Oxford, 1991, 2nd edition.
3. Molecular Biology of the Gene, J.D.Watson, N.H.Hopkins, J.W.Roberts, J.A. Steitz and A.M.Weiner, The Benjamin/Cummings Publ. Co., Inc., California, 1987, 2nd edition.
4. Genes VI, Benjamin Lewin, Oxford University Press, U.K., 6th Edition, 1998.
5. Molecular biology and Biotechnology. A comprehensive desk reference, R.A. Meyers (Ed) VCH Publishers, Inc., New York, 1995

PROGRAMME	M.Sc BIOTECHNOLOGY
SEMESTER	ONE
SUBJECT	BIOCHEMISTRY
COURSE CODE	15 MBT 102

UNIT – I

Structure of atoms, molecules and chemical bonds. Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins).

UNIT - II

Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.). Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties).

UNIT - III

Bioenergetics, Glycolysis, Oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers. Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes.

UNIT - IV

Conformation of proteins (Ramachandran plot, secondary, tertiary and quaternary structure; domains; motif and folds). Conformation of nucleic acids (A-, B-, Z- DNA), t-RNA, micro-RNA).

UNIT - V

Stability of protein and nucleic acid structures. Metabolism of carbohydrates, lipids, amino acids, nucleotides and vitamins.

TEXT BOOKS:

1. Fundamentals of Biochemistry – Voet and Voet, John Wiley and Sons Inc., 4th edition 2005.
2. Principles of Biochemistry- Lehninger, Nelson, Cox, CBS publishers 4th edition, 1998.

REFERENCES:

1. Principles of Biochemistry – Smith, McGraw Hill International book company, 8th edition, 2001.
2. Biochemistry – J L Jain, Sunjay Jain, Nitin Jain, S Chand & Company, 6th edition, 2005.
3. Harpers Biochemistry, R.K. Murray, D.K. Granner, P.A. Mayes and V.W. Rodwell. Prentice Hall International, 3rd edition, 2003.

PROGRAMME	M.Sc BIOTECHNOLOGY
SEMESTER	ONE
SUBJECT	GENETICS
COURSE CODE	15 MBT 103

UNIT – I

Mendelian principles: Dominance, segregation, independent assortment, deviation from Mendelian inheritance. Concept of gene: Allele, Multiple alleles, Pseudoallele, Complementation tests. Extensions of Mendelian principles: Codominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters.

UNIT – II

Gene mapping methods: Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants. Extra chromosomal inheritance: inheritance of Mitochondrial and chloroplast genes, Maternal Inheritance. Microbial genetics: Methods of genetic transfers – transformation, conjugation, transduction and sex-duction, Mapping genes by interrupted mating, Fine structure analysis of genes.

UNIT - III

Human genetics: Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders. Quantitative genetics: Polygenic inheritance, heritability and its measurements, QTL mapping. Mutation: Types, causes and detection, mutant types – Lethal, Conditional, Biochemical, loss of function, gain of function, germinal versus somatic mutants, insertional mutagenesis.

UNIT - IV

Structural and numerical alterations of chromosomes: Deletion, duplication, inversion, translocation, ploidy and their genetic implications. Recombination: Homologous and non-homologous recombination, including transposition, site-specific recombination.

UNIT - V

The Mechanisms: Population genetics – populations, gene pool, gene frequency; Hardy-Weinberg law; concepts and rate of change in gene frequency through natural selection, migration and random genetic drift; adaptive radiation and modifications; isolating mechanisms; speciation, allopatricity and sympatricity; convergent evolution; sexual selection; co-evolution

TEXT BOOK:

1. Genetics – Strickberger, Printice Hall of India Pvt ltd, 3rd edition.1999.

REFERENCE:

1. Genetics by Peter Russell Pearson , Tata Mc Graw hill, 2nd edition, 2001.
2. Genetics by Goodenough, Saunders College Publication, 3rd edition, 2003.

PROGRAMME	M.Sc BIOTECHNOLOGY
SEMESTER	ONE
SUBJECT	MICROBIOLOGY
COURSE CODE	15 MBT 104

UNIT –I

The History and scope of Microbiology, Study of microbial structure. Light Microscope, Electron Microscope, Newer techniques in Microscopy, Preparation and staining of specimen. Pattern of cell wall formation.

UNIT – II

Microbial taxonomy and phylogeny: Bacteria, Virus: Introduction and general characteristics of virus, Cultivation of virus, virus purification and assay, viral structure, reproduction of Bacteriophages and viruses, viroids and prions.

UNIT – III

Microbial nutrition: Nutrient requirements, nutritional type of microbes, growth factors, uptake of nutrient by cells, culture media, microbial growth and food spoilage, controlling food spoilage, control of microorganisms by physical and chemical agents.

UNIT – IV

Host parasite interaction: Recognition and entry processes of different pathogens like bacteria, viruses into animal and plant host cells, alteration of host cell behavior by pathogens, virus-induced cell transformation, pathogen-induced diseases in animals and plants, cell-cell fusion in both normal and abnormal cells.

UNIT – V

Microbial disease and their control: Pathogenicity of microorganisms, Specimens in clinical microbiology, Identification of microorganisms from specimens, Susceptibility testing, human diseases caused by viruses, bacteria, fungi and protozoa. Antimicrobial chemotherapy.

TEXT BOOKS:

1. Microbiology –Prescott, Harley, Klein. WmC, Brown Publishers, 6th edition, 2007.
2. Microbiology An introduction – Tortora, Funke.R, L. Case., ASM Press, 8th edition, 1992.

REFERENCES:

1. Applied Microbiology – S. Trivedi, TBH Publications, 1998, 1st edition.
2. General Microbiology – Stainer Ingraham Wheelis Painter, Mac Millan Press Ltd. 2004, 5th edition.
3. General Microbiology – Volume II Powar and Daginwala, Himalayas Publishing House, 1992, 1st edition.

PROGRAMME	M.Sc. BIOTECHNOLOGY
SEMESTER	ONE
SUBJECT	PRACTICAL –I LAB IN CELL BIOLOGY AND BIOCHEMISTRY
COURSE CODE	15 MBT 105

1. Mitosis Mounting of onion root tip for mitosis
2. Meiosis in flower buds of Allium cepa (Onion)
3. Barr body staining from buccal epithelial cells
4. Isolation of chloroplasts from leaves
5. Molecular weight determination of protein (BSA) by SDS – PAGE
6. Estimation of Protein – Lowry’s Method, Biuret method
7. Estimation of Sugars – Dinitro salicylic Method
8. Estimation of DNA – Diphenyl amine Method
9. Estimation of RNA – Orcinol Method
10. Paper Chromatography for amino acid separation
11. Thin Layer Chromatography for isolation of amino acid
12. Column Chromatography packing and isolation of compounds

References:

1. Biochemical Methods- S. Sadasivam and A. Manickam, 2nd edition.
2. Experimental Procedures in Life Sciences – Dr. S. Rajan and Mrs. R. Selvi Christy, Anjana Book House, 1st edition, 2010.

PROGRAMME	M.Sc. BIOTECHNOLOGY
SEMESTER	ONE
SUBJECT	PRACTICAL –II LAB IN MICROBIOLOGY
COURSE CODE	15 MBT106

1. Culture media preparation – Liquid and Solid Medium
2. Selective differential media
3. Methods of Sterilization and Testing of Sterility
4. Measurement of Bacterial Growth (Side On method)
5. Pure Culture Technique – Pour Plate, Spread Plate and Looping Method
6. Isolation and Enumeration of Microbes from Soil, Air and Water.
7. Biochemical Identification of Bacteria
8. Maintenance and Preservation of Culture – Slant, Stab, Plating and Lyophilization
Methods
9. Staining of Bacteria – Gram, Spore and Acid fast Staining
10. Identification of Fungus – LPCB
11. Motility Test – Hanging Drop
12. Antibiotic Susceptibility Test by Disc Diffusion and MIC method.

References:

1. Experimental Procedures in Life Sciences – Dr. S. Rajan and Mrs. R. Selvi Christy,
Anjana Book House, 1st edition, 2010.

PROGRAMME	M.Sc BIOTECHNOLOGY
SEMESTER	TWO
SUBJECT	IMMUNOLOGY AND IMMUNOTECHNOLOGY
COURSE CODE	15 MBT 201

UNIT -I

History and scope of Immunology. Types of Immunity- Innate, adaptive, Humoral and cell mediated Immunity. Cells of the immune system: Hematopoiesis and differentiation, B and T lymphocytes & epitopes, Macrophages, Dendritic cells, Natural killer cells, Eosinophils, Neutrophils and Mast cells. Organization and structure of primary and secondary lymphoid organs, Primary and secondary immune response.

UNIT –II

Antibodies: Structure, types, properties, functions, and classes of immunoglobulin, Biology of antigens, Nature and biology of super Antigens, Antigen – Antibody interactions, Applications of immunological techniques, Monoclonal Antibody production and applications, MAbs in diagnosis and therapy. Catalytic antibodies. Generation of antibody diversity, Primary and secondary immune modulation, The Complement system, Toll-like receptors, Cell-mediated effector functions

UNIT- III

Major Histocompatibility complex, Antigen processing and presentation, Activation of T lymphocytes, Immunological tolerance- T cell and B cell tolerance to antigens, Biology of Complement system, Cytokines and their role in immune regulation.

UNIT- IV

Hypersensitivity reactions Type I, II, III & IV, Auto immune disorders, AIDS and other Immunodeficiencies – Primary and secondary immunodeficiencies, Structure of HIV, envelope glycoproteins, Destruction of T cells, Immunity to infectious agents (intercellular parasites, helminthes, bacteria and viruses)

UNIT -V

Vaccine technology and recombinant vaccines, Tumor immunology: Tumor antigens, immune response to tumors, cancer immunotherapy. Transplantation – Bone marrow transplantation, organ transplants, Immunosuppressive therapy. Application of immunological principles (vaccines, diagnostics). Tissue and cell culture methods for plants and animals.

TEXT BOOKS:

1. Janis Kuby, Immunology, WH Freeman & Company, New York, 5th edition, 2002.
2. I.R.Tizard, Immunology: An Introduction, Saunders College Publishers, New York. 1995, 4th edition.

REFERENCES:

1. Essentials of Immunology, Roitt, I.M., Brestoff and Male, D.K, Blackwell Scientific Publications, Oxford, 1996, 6th Edition.
2. A. Bul and K.Abbas, 1994, Cellular and Molecular immunology, 1st edition.
3. Fundamentals of Immunology: Paul W.E, 5th (Eds.) Raven Press, New York, 1988.
4. Immunobiology, Janeway, C.A and Paul Travers, 2007, 7th edition.

PROGRAMME	M.Sc BIOTECHNOLOGY
SEMESTER	TWO
SUBJECT	GENETIC ENGINEERING
COURSE CODE	15 MBT 202

UNIT – I

Basic techniques for gene manipulation, Isolation, purification of RNA , DNA (genomic and plasmid) and proteins, different separation methods; analysis of RNA, DNA and Proteins by one and two dimensional gel electrophoresis, Cutting and joining DNA molecules, Selectable marker systems for mammalian expression vectors, Cloning strategies, gene libraries and cDNA cloning, Directed Mutagenesis and Protein Engineering.

UNIT – II

Recombinant selection and screening, Genomic DNA libraries, cDNA library, Library Screening – Hybridization, Immunological screening, Cloning in bacteria other than E.coli, Cloning in Saccharomyces cerevisiae and other microbial eukaryotes. Expression of recombinant proteins using bacterial, animal and plant vectors.

UNIT – III

Generation of genomic and cDNA libraries in plasmid, phage, cosmid, BAC and YAC vectors; in vitro mutagenesis and deletion techniques, gene knock out in bacterial and eukaryotic organisms; protein sequencing methods, detection of post-translation modification of proteins; DNA sequencing methods, strategies for genome sequencing; methods for analysis of gene expression at RNA and protein level, large scale expression analysis such as microarray based techniques; isolation, separation and analysis of carbohydrate and lipid molecules; RFLP, RAPD and AFLP techniques.

UNIT – IV

Gene targeting, Gene transfer to plant and animal cells, Gene silencing and antisense technology, Gene therapy for inherited diseases, ADA, FH, Cystic fibrosis, DHA, Neoplastic disorders, infectious diseases, DNA Forensics, Molecular genetic pathophysiology. Oncogenes and Anti - Oncogenes.

UNIT – V

Antibiotics – Synthesis of novel antibodies, Improving Antibiotic production, Peptide antibiotics, and Microbial synthesis of commercial products: Engineering human interferon, engineering human growth hormone, Synthesis of small biological molecules.

TEXT BOOKS:

1. Principles of Gene Manipulation – An Introduction to genetic engineering – R.W. Old and S. B. Primrose, 5th edition, Blackwell Publishing.
2. Molecular Biotechnology – Principles and Applications of Recombinant DNA – Bernard.R.Glick and Jack.J Pasternak, 3rd edition, 2007, ASM Press.

REFERENCES:

1. Molecular Biotechnology - Principles and Applications of Recombinant DNA – Bernard.R.Glick and Jack.J. Pasternak, Indian 2nd edition, 2005, New Age International Pvt Ltd.
2. Molecular Biotechnology – R.M. Twymann, 2006, Blackwell Publishing, 7th edition.
3. Recombinant DNA Principles and Methodologies – James J. Greene, CRC Press, 1st edition.
4. An Introduction to Gene Cloning – T. A. Brown, 3rd edition, 2006, Blackwell Publishing.

PROGRAMME	M.Sc., BIOTECHNOLOGY
SEMESTER	TWO
SUBJECT	MOLECULAR BIOLOGY
COURSE CODE	15 MBT 203

UNIT – I

Organization of genes and chromosomes: Operon, interrupted genes, gene families, Structure of chromatin and chromosomes, Unique and Repetitive DNA, Heterochromatin, Euchromatin, Transposons.

UNIT - II

DNA replication, repair and recombination: Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extra chromosomal replicons, DNA damage and repair mechanisms. Types of recombination.

UNIT - III

RNA synthesis and processing: Transcription factors and machinery, formation of initiation complex, transcription activators and repressors, RNA polymerases, capping, elongation and termination, RNA processing, RNA editing, splicing, polyadenylation, structure and function of different types of RNA, RNA transport.

UNIT - IV

Protein synthesis and processing: Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, translational proof-reading, translational inhibitors, post- translational modification of proteins.

UNIT - V

Control of gene expression at transcription and translation level: Regulation of phages, viruses, prokaryotic and eukaryotic gene expression, role of chromatin in regulating gene expression and gene silencing.

TEXT BOOKS:

1. Molecular Cell Biology, Darnell, Lodish, Baltimore, Scientific American Books. Inc. 1994, 2nd edition.
2. Molecular Biology of cell, Alberts. B *et al* 2002, Mc Graw hill, 2nd edition.
3. Cell & Molecular Biology- E.D.P, De Robertis, 8th edition, B.I. Publications.
4. Principles of Biochemistry- Lehninger, Nelson, Cox, CBS publishers, 4th edition, 1998.

REFERENCES:

1. Molecular and Cellular Biology, Stephen L.Wolfe, Wadsworth Publishing Company, 1993, 1st edition.
2. Molecular Biology LabFax, T.A. Brown 3rd (Ed), Bios Scientific Publishers Ltd., 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.Weiner, The Benjamin Cummings Publ. Co., Inc., California, 1987.
4. Genes VI, 6th Edition, Benjamin Lewin, Oxford University Press, U.K., 1998.
5. Molecular Biology and Biotechnology. A comprehensive desk reference, R.A. Meyers (Ed) VCH Publishers, Inc., New York, 1995, 2nd edition.

PROGRAMME	M.Sc. BIOTECHNOLOGY
SEMESTER	TWO
SUBJECT(ELECTIVE I)	INDUSTRIAL BIOTECHNOLOGY
COURSE CODE	15 MBT 204

UNIT – I

Isolation of microbes, primary and secondary screening, strain development, preservation of microbes – serial subculture, cultures with mineral oil, lyophilization, storage at low temperature, storage for fungi, stock culture, fermentation media and related factors, energy sources, inoculum preparation , industrial sterilization.

UNIT – II

Dual fermentation, continuous fermentation, solid state fermentation, submerged fermentation. Batch fermentor, Continuous stirred tank fermentor, Tubular, Fluidized bed fermentor, Mechanically agitated stirred tank reactor, Air lift bioreactor, Temperature control, pH, DO, Antifoam control and other factors, Biosensors.

UNIT – III

Antibiotics production – Penicillin, Streptomycin, Tetracycline. Organic acids production - Citric acid, Lactic acid, Itaconic acid, Acetic acid, Gluconic acid. Amino acids production – L glutamic acid, L lysine. Solvents production – Ethanol, Glycerol, Acetone - Butanol.

UNIT – IV

Vitamins production – Vitamin B Complex and Vitamin C. Enzyme production – Amylase, Proteinase, Pectinases, Cellulase and Lactase. Extraction and purification of enzymes. Enzyme immobilization, characteristics, immobilization technology for cells, Applications of microbial enzymes.

UNIT – V

Production of Brewer's yeast, Baker's yeast, Food and fodder yeast, Use of yeast and yeast products, Production of microbial proteins and uses – Bacterial, fungal, and algal protein, Mushroom culture and uses – cultivation methods, Production of microbial insecticides, microbes. Recovery and purification of fermentation products – Precipitation, filtration, centrifugation, chromatography, membrane process, drying.

TEXT BOOKS:

1. Principles of Fermentation Technology – Stanbury and Whittaker, Elsevier Science Ltd, 2nd edition, 2007.

REFERENCES:

1. Industrial Microbiology – L. E. Casida, 3rd edition, PI Publication, 2000.
2. Industrial Microbiology – A.H.Patel, TBH publication 2nd edition, 2003.
3. Biotechnology A text book of Industrial Microbiology – Wulf Crueger and Anneliese Crueger, Elsevier science ltd, 3rd edition 1997.
4. Industrial Biotechnology – Prescott and Dunn, 4th edition, 2003, The AVI Publishing Company.

PROGRAMME	M.Sc. BIOTECHNOLOGY
SEMESTER	TWO
SUBJECT (Elective I)	FOOD BIOTECHNOLOGY
COURSE CODE	15 MBT 204A

UNIT I

DIARY PRODUCTS: Cheese- principles of cheese making, general methods Cheddar Cheese; Swiss Cheese; Surface ripened Cheeses; Mold ripened Cheeses, Cheese spoilage and public health – Staphylococcal , Salmonellosis, E-coli, Botulism, Aflatoxin and Amine production.

UNIT II

FERMENTED DIARY PRODUCTS: Biochemical basis of fermentation – production of starter cultures, general principles of manufacture of coloured buttermilk, cultured cream; Yogurt; Acidophilus milk, Kefir, Koumiss, Cottage Cheese and Cream Cheese.

UNIT III

OTHER FERMENTED PRODUCTS: Soy sauce, Ang-kak fermented fish products. Sauer Krant pickles, fermentation of Olives, fermented sausages, production – bread, organic acid, acetic acid, lactic acid and citric acid: amino acids: glutamic acid, lysine threonine, arginine and histidine.

UNIT IV

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 (source and application only).

UNIT V

Food preservation – Heat processing, pasteurization, spoilage of canned food, Irradiation-microwave, UV ionizing radiations, Pascalization, Chilling and freezing, Chemical preservatives – Organic acids & esters, Nitrite, Sulphur dioxide, Modification of atmosphere, control of water activity, Compartmentalization.

TEXT BOOK

1. Food Microbiology – M.R. Adams and M.O. Moss Royal society Pub. Cambridge, 2nd edition, 1995.
2. Basic Food Microbiology – George J Ban wart, 2nd edition.

REFERENCES:

1. Food Microbiology William, C. Frazier, Dennis, C. Westhoff Tata Mc Graw Hill Publications, 3rd edition, 1998.
2. Perspectives in Biotechnology and Applied Microbiology, - Daham I Alani and M.M. Young, 2nd edition, 2003.

PROGRAMME	M.Sc.BIOTECHNOLOGY
SEMESTER	TWO
SUBJECT(ELECTIVE-I)	GENE SILENCING TECHNOLOGY
COURSE CODE	15 MBT 204B

UNIT I

Antisense tools: Introduction of Antisense Oligos, Antisense RNA, PTGS, siRNA, dsRNA, shRNA and miRNA. DICER, RISC and RdRps.

UNIT II

RNA-interference in *Caenorhabditis elegans*: Introduction, application of RNAi in *C. elegans*, Generation of dsRNA, Various methods of introducing RNAi into *C. elegans*, Genome-wide RNAi Based Screen for Genes Important in Cell Division, RNAi Database for *C. elegans*.

UNIT III

RNAi in Plants and *Drosophila*: Introduction, application of RNAi in plants and *Drosophila*, Methods of introducing RNAi into Plants, *Drosophila* and *Drosophila* cell lines, High-Throughput screening.

UNIT IV

RNAi in Mammals: Introduction, siRNA synthesis and modifications, Tuschl rules, Delivery of siRNAs: Transient and Stable transfections of siRNA into mammalian cell lines, shRNA - synthesis and cloning in vector with promoters; viral mediated delivery of shRNA, inducible RNAi cassettes.

UNIT V

Applications of RNAi in Mice, Generation of Transgenic and Knock-out mice with RNAi, RNAi in Gene therapy, RNAi in Microarray, High-Throughput screening with RNAi, RNAi in immunology.

REFERENCES :

1. RNA Interference in Practice: Principles, Basics, and Methods for Gene Silencing in *C. elegans*, *Drosophila* and Mammals, 2005, Ute Schepers.
2. RNAi: A Guide to Gene Silencing, Gregory J. Hannon, 2003.

PROGRAMME	M.Sc. BIOTECHNOLOGY
SEMESTER	TWO
SUBJECT	PRACTICAL –III LAB IN BIOPROCESS AND IMMUNOTECHNIQUES
COURSE CODE	15 MBT 205

1. Effect of pH and temperature on growth kinetics.
2. Downstream process – purification of anyone protein from fermented broth
3. Determination of Specific Activity of Amylase/ Protease
4. Preparation of Blood smear and Staining using Leishman’s Stain
5. Haemagglutination Test
6. ASO Test
7. RA and CRP Test
8. Preparation of Antiserum using Adjuvant
9. Ammonium Sulphate Precipitation of Antisera
10. Immuno Electrophoresis
11. Rocket Immuno Electrophoresis
12. ELISA Test
13. Hemolysis Test using Hypertonic Solution
14. Purification of Lymphocytes

References:

1. Experimental Procedures in Life Sciences – Dr. S. Rajan and Mrs. R. Selvi Christy,
Anjana Book House, 1st edition, 2010.

PROGRAMME	M.Sc. BIOTECHNOLOGY
SEMESTER	TWO
SUBJECT	PRACTICAL –IV LAB IN GENETIC ENGINEERING
COURSE CODE	15 MBT 206

1. Isolation of genomic DNA from plant sample
2. Isolation of genomic DNA from animal sample
3. Isolation and analysis of purity of (260-280) overnight culture of genomic DNA from Bacterial sample
4. Isolation of plasmid DNA from bacterial sample
5. Isolation of RNA
6. Recovery of DNA from Agarose gel
7. Southern blotting technique.
8. Restriction digestion
9. Restriction mapping of plasmid DNA
10. PCR
11. Bacterial transformation

References:

1. Experimental Procedures in Life Sciences – Dr. S. Rajan and Mrs. R. Selvi Christy, Anjana Book House, 1st edition, 2010.

PROGRAMME	M.Sc.BIOTECHNOLOGY
SEMESTER	TWO
SUBJECT (SC)	DEVELOPMENTAL BIOLOGY
COURSE CODE	

UNIT I

Basic concepts of development: Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development.

UNIT II

Gametogenesis, fertilization and early development: Production of gametes, cell surface molecules in sperm-egg recognition in animals; embryo sac development and double fertilization in plants; zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis, establishment of symmetry in plants; seed formation and germination.

UNIT III

Morphogenesis and organogenesis in animals: Cell aggregation and differentiation in *Dictyostelium*; axes and pattern formation in *Drosophila*, amphibia and chick; organogenesis – Vulva formation in *Caenorhabditis elegans*; eye lens induction, limb development and regeneration in vertebrates; differentiation of neurons, post embryonic development - larval formation, metamorphosis.

UNIT IV

Morphogenesis and organogenesis in plants: Organization of shoot and root apical meristem; shoot and root development; leaf development and phyllotaxy; transition to flowering, floral meristems and floral development in *Arabidopsis* and *Antirrhinum*.

UNIT V

Programmed cell death, aging and senescence: Environmental regulation of normal development; sex determination.

TEXT BOOK:

1. Introduction to the embryology of Angiosperms — Maheswari P, Mc Graw Hill, 3rd edition, 1981.

REFERENCE BOOKS:

1. An introduction to Embryology – Balansky, Oxford University press, 2nd edition, 1981.
2. Developmental Biology Pattern, Principles and Problems -- Sacendus J.W. Springer Publications, 3rd edition, 1985.
3. The embryology of Angiosperms – Bovjani and Bhatnagar , Vilas publications, 2nd edition, 1978.

PROGRAMME	M.Sc.BIOTECHNOLOGY
SEMESTER	TWO
SUBJECT (SC)	PLANT PHYSIOLOGY
COURSE CODE	

UNIT – I

Photosynthesis: Light harvesting complexes; mechanisms of electron transport, photoprotective mechanisms; CO₂ fixation-C₃, C₄ and CAM pathways. Respiration and photorespiration: Citric acid cycle; plant mitochondrial electron transport and ATP synthesis; alternate oxidase; photorespiratory pathway.

UNIT - II

Nitrogen metabolism: Nitrate and ammonium assimilation; amino acid biosynthesis. Plant hormones: Biosynthesis, storage, breakdown and transport; physiological effects and mechanisms of action.

UNIT - III

Sensory photobiology: Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins; stomatal movement; photoperiodism and biological clocks.

UNIT - IV

Solute transport and photoassimilate translocation: Uptake, transport and translocation of water, ions, solutes and macromolecules from soil through cells, across membranes, through xylem and phloem; transpiration; mechanisms of loading and unloading of photoassimilates.

UNIT - V

Secondary metabolites - Biosynthesis of terpenes, phenols and nitrogenous compounds and their roles. Stress physiology: Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses; mechanisms of resistance to biotic stress and tolerance to abiotic stress.

TEXT BOOK:

1. Introduction to Plant physiology – William G. Hopkins, Wiley and sons, 2nd edition, 1999.

REFERENCES:

1. Plant physiology – Lincoln taiz, Eduardo Zeiger, Sinauer associates, 2nd edition, incorporated, 1998.
2. Plant Biochemistry and Molecular Biology – P.J. Lea and R.C. Leegood, 2nd edition, John Wiley and Sons, 1993.
3. Plant Genes and Agriculture – M.J. Chrisped D.F. Sadava, 3rd edition, Jones and Barlett Publicaions.

PROGRAMME	M.Sc.BIOTECHNOLOGY
SEMESTER	TWO
SUBJECT (SC)	ANIMAL PHYSIOLOGY
COURSE CODE	

UNIT I

Blood and circulation: Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, immunity, haemostasis. Cardiovascular System: Comparative anatomy of heart structure, myogenic heart, specialized tissue, ECG – its principle and significance, cardiac cycle, heart as a pump, blood pressure, neural and chemical regulation .

UNIT II

Respiratory system: Comparison of respiration in different species, anatomical considerations, transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration.

UNIT III

Nervous system: Neurons, action potential, gross neuroanatomy of the brain and spinal cord, central and peripheral nervous system, neural control of muscle tone and posture. Sense organs: Vision, hearing and tactile response.

UNIT IV

Excretory system: Comparative physiology of excretion, kidney, urine formation, urine concentration, waste elimination, micturition, regulation of water balance, blood volume, blood pressure, electrolyte balance, acid-base balance.

UNIT V

Thermoregulation: Comfort zone, body temperature – physical, chemical, neural regulation, acclimatization. Digestive system: Digestion, absorption, energy balance, BMR. Endocrinology and reproduction: Endocrine glands, basic mechanism of hormone action, hormones and diseases; reproductive processes, neuroendocrine regulation.

TEXT BOOKS:

1. Principles of Animal Physiology – Christopher – D. Moyer Patania M. Schutle, Benjamin Canning pub, 2nd edition, 2007.

REFERENCES:

1. Genetic Engineering of Animals - A. Duhla Weinhein FRG – 2nd edition, 1993, VCH Publications.
2. Plant and Animal Physiology – Peter.J. Russel , Paul.E. Hertz Cecie Starr, Stephen.L. Worke – Eengage learning, 1st edition, 2005.
3. Animal Physiology – Richard.W.Hill, Gardon.A. Wyse, Margaret.Andena. Sinauer Association, 1st edition, 2004.

PROGRAMME	M.Sc BIOTECHNOLOGY
SEMESTER	THREE
SUBJECT	PLANT BIOTECHNOLOGY
COURSE CODE	15 MBT 301

UNIT – I

Tissue culture media (composition and preparation), Callus and suspension culture; Micropropagation, Somaclonal variation, Organogenesis; Somatic embryogenesis; Haploidy; Anther, pollen and ovary culture for production of haploid plants and homozygous lines. Embryo culture and embryo rescue.

UNIT II

Protoplast fusion and somatic hybridization; Cybrids, Artificial seeds, hardening-transfer and establishment of whole plants in soil. Plant hormones, Auxins, cytokinins, Gibberellins, ethylene. Genome organization in plants: Nucleus, Chloroplast and Mitochondrial genome organization; Molecular Marker aided Breeding: RFLP and RAPD markers, Micro satellites, SCAR (Sequence Characterized Amplified Regions). QTL map based cloning.

UNIT III

Methods of gene transfer in plants: Physical methods of gene transfer, Particle bombardment, Electroporation, microinjection, chemical mediated transformation, silicon carbide mediated gene transfer. Transplastomics: Chloroplast transformation: advantages. Plant transformation technology: *Agrobacterium tumefaciens* as plant genetic engineer: features of Ti and Ri plasmids, use of Ti and Ri as vectors, genetic markers, use of reporter genes, viral vectors and their applications. Transformation of monocots. Transgene stability and gene silencing.

UNIT IV

Application of plant transformation for productivity and performance; Engineering plants for herbicide resistance, insect resistance, Virus resistance, disease resistance, nematode

resistance, abiotic stress resistance. PR proteins, Bt genes, Non-Bt like protease inhibitors, alpha amylase inhibitor, Flavr Savr long shelf life of fruits and flowers.

UNIT V

Metabolic engineering and Industrial Products: plant secondary metabolites, control mechanisms and manipulation of shikimate pathway; alkaloids, enzymes, plantibodies, edible vaccines, Golden rice, blue rose.

TEXT BOOKS:

1. Introduction to Plant Biotechnology by H.S. Chawla, 2002, Oxford and IBH P Publishing Co.Pvt. Ltd. New Delhi.
2. Plant Molecular Biology by Grierson and Convey, 1984, Blackie and Son Ltd, New York

REFERENCES:

1. An Introduction to genetic engineering in plants, Mantel S.H, Mathews J.A. Mickee R.A.2001,4th edition Academic Press
2. Elements of Biotechnology, P.K. Gupta, 1996. Rastogi and Co. Meerut
3. Plant cell culture, A practical approach, 2nd ed., Edited by R.A. Dixon and R.A. Gonzales, 1994. Oxford University Press, Oxford
4. Practical Application of Plant Molecular biology by R.J. Henry, 1997, Chapman and Hall
5. Plant Biotechnology by J. Hammond, P. McGarey and V. Yusibov (Eds) 2000, Springer

PROGRAMME	M.Sc. BIOTECHNOLOGY
SEMESTER	THREE
SUBJECT	ANIMAL BIOTECHNOLOGY
COURSE CODE	15 MBT 302

UNIT I

Animal cell culture media; Natural media, synthetic media, constituents of media and media preparation and sterilization, Equipments required for a animal cell culture, Aseptic technique, culture vessels and substrates used in animal culture.

UNIT II

ANIMAL CELL AND TISSUE CULTURE; Isolation of animal material by physical enzymatic methods (cell disaggregation), Primary culture, sub culture and establishment of cell lines. Types of cell lines, maintenance of cell lines, cloning of cell lines, tissue culture, organ culture Histotypic culture, Imaging cells in 3D constructs and scale up, whole embryo culture, cryo- preservation.

UNIT III

INVITRO FERTILIZATION AND EMBRYO TRANSFER IN HUMANS AND LIVESTOCK.IVF in Humans embryo transfer in human: super ovulation, IVF and embryo culture in animals; embryo transfer in cattle's. SPECIALIZED TECHNIQUES IN CELL CULTURE: In Situ molecular hybridization, somatic cell fusion production of Monoclonal Antibodies & cells application DNA transfer methods, targeted gene transfer, gene silencing and knock out mice.

UNIT IV

Transgenic Animals: Transgenic Mice, Transgenic cattle, transgenic sheep, Transgenic Chickens, Transgenic pigs, transgenic fish and transgenic rabbits, Applications.

UNIT V

ANIMAL BIOTECHNOLOGY IN MEDICINE: Animal and human health care – Recombinant vaccines, gene therapy, tissue engineering, Ethical issues in Animal Biotechnology.

TEXT BOOK:

1. Molecular Biotechnology- Principles, applications of recombinant DNA Bernard, R. Glick and Tack. J. Pasternak, 3rd edition, 2007, ASM Press.

REFERENCES

1. Culture of Animal Cells, A manual of basic technique, 5th Edition, R.Ian Freshney, 2000.
2. Animal Cell Biotechnology – Portner, 2nd edition, 2007, humana press
3. Biotechnology – Fundamentals and application, 4th edition, S.S. Purohit, 2004

PROGRAMME	M.Sc., BIOTECHNOLOGY
SEMESTER	THREE
SUBJECT	BIOINSTRUMENTATION AND BIOSTATISTICS
COURSE CODE	15 MBT 303

UNIT I

Histochemical and immunotechniques: Antibody generation, detection of molecules using ELISA, RIA, western blot, immunoprecipitation, flowcytometry and immunofluorescence microscopy, detection of molecules in living cells, *in situ* localization by techniques such as FISH and GISH.

UNIT II

Biophysical methods: Analysis of biomolecules using UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy, structure determination using X-ray diffraction and NMR; analysis using light scattering, different types of mass spectrometry and surface plasma resonance methods. Computational methods: Nucleic acid and protein sequence databases; data mining methods for sequence analysis, web-based tools for sequence searches, motif analysis and presentation.

UNIT III

Radiolabeling techniques: Properties of different types of radioisotopes normally used in biology, their detection and measurement; incorporation of radioisotopes in biological tissues and cells, molecular imaging of radioactive material, safety guidelines.

UNIT IV

Microscopic techniques: Visualization of cells and subcellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission microscopes, different fixation and staining techniques for EM, freeze-etch and freeze-fracture methods for EM, image processing methods in Microscopy.

UNIT V

Statistical Methods: Measures of central tendency and dispersal; probability distributions (Binomial, Poisson and normal); sampling distribution; difference between parametric and non-parametric statistics; confidence interval; errors; levels of significance; regression and correlation; t-test; analysis of variance; χ^2 test; basic introduction to Multivariate statistics.

TEXT BOOKS:

1. Physical Biochemistry – Application to Biochemistry and Molecular Biology- Friefelder D.M, W. H. freeman, 1982, 2nd edition
2. Text book of statistics- Gupta, Students edition, Himalaya Publishers

REFERENCE BOOKS:

1. Principles and Techniques in Practical Biochemistry, Wilson and Walker, Cambridge University Press, 2000, 5th edition

PROGRAMME	M.Sc., BIOTECHNOLOGY
SEMESTER	THREE
SUBJECT (ELECTIVE-I)	PROTEOMICS AND GENOMICS
COURSE CODE	15 MBT304

UNIT – I

Genomes: Viruses – Bacteriophages and viruses of eukaryotes, Prokaryotic genomes, Eukaryotic genomes. The human genome – the content of the human nuclear genome, genes, related sequences and functions. Pseudo genes and other evolutionary relics, Genome anatomies – Prokaryotic and eukaryotic.

UNIT – II

Genomics: Types of genomics – Structural and functional genomics. Genome Sequencing – Methodology for DNA Sequencing. Sequencing entire genomes – Strategies for genome sequencing. Sequence assembly and gap closure.

UNIT – III

Mapping genomes: Genetic mapping – DNA markers for genetic mapping, Physical mapping – Restriction mapping, Fluorescent *insitu* hybridization (FISH), and Sequence tagged site mapping, RFLP, AFLP. Analyzing gene expression – DNA microarrays – design, analysis and visualization of data, RNA data handling/manipulation.

UNIT – IV

Proteomics: Types of proteomics – expression, structural and functional proteomics. Methods to quantitate proteins: Proteomic methods – Two dimensional gel electrophoresis (2-DE), Mass Spectrometry: ESI-MS, MALDI, MALDI-TOF; Protein expression analysis – RNA interference (RNAi).

UNIT – V

Human Genome Projects – mapping, sequencing and the future of human genome project. Comparative genomics – Comparative genomes of bacteria, organelles and eukaryotes. Comparative genomics in the study of human disease genes. Genomics and its application to health and agriculture, including gene therapy.

TEXT BOOKS:-

1. Genomes – T.A.Brown, 2nd edition 2005, Bioscientific publishers.
2. Principles of gene manipulation and genomics – S.B. Primrose and R.M.Twymann, 7th edition.

REFERENCES:-

1. Genetics – A molecular approach – T.A.Brown, 5th edition, 2006.
2. Text book of Biotechnology – R.C.Dubey, 3rd edition, S.Chand and Company limited, 2001.
3. Molecular Cell Biology – Lodish, 5th edition, W.H.Freemann, 2000.

PROGRAMME	M.Sc. BIOTECHNOLOGY
SEMESTER	THREE
SUBJECT (ELECTIVE II)	AGRO INDUSTRIAL BIOTECHNOLOGY
COURSE CODE	15 MBT 304 A

UNIT I

Agro Industrial Biotechnology: Introduction History, Importance and Applications of Biotechnology in Agro based industries. Significant advances recent development risk factors, safety regulations.

UNIT II

Bioprocessing : Industrial use of Micro organisms, Industrially important microorganisms, microbes exploited commercially – Saccharomyces, Lactobacillus, Penicillum, Acetobactor, Bifidobacterium, Lactococcus, Streptococcus etc., Fermentation process, Media and systems, Upstream and downstream processing product development dairy fermentation and fermented products.

UNIT III

Microbial enzymes in food processing: Industrial production of enzymes proteases and cellulases: Food and beverage fermentation – alcoholic and non alcoholic beverages. Food additives and supplements – probiotics, health care products, vitamins and antibiotics.

UNIT IV

Modification of microbes enzymes – strain improvement, enzyme cofactor, engineering: technologies for microbial inactivation, applications in product development, Improvement. Immobilization, Biosensors.

UNIT V

Waste management in agro industry. Types of wastes segregation of wastes. Wastes and waste water treatment. Primary, secondary, and tertiary treatments. Biocompost.

TEXT BOOK

1. Environmental Biotechnology – B.C. Bhattacharya and R. Banerjee, Oxford University, press, 2nd edition, 2004.

RERFERENCES

1. Food science and food biotechnology, Gutierrez – Lopez, G. F., CRC Publishers, Washington, 2003.
2. Principles of fermentation technology 2nd edition Stanbury,P.F. *et. al.*, Elsevier, UK 1995
3. Industrial biotechnology: An Introduction, Waites M *et al.*, Blackwell publishing UK 2007.

PROGRAMME	M.Sc. BIOTECHNOLOGY
SEMESTER	THREE
SUBJECT (ELECTIVE II)	CLINICAL BIOTECHNOLOGY
COURSE CODE	15 MBT 304 B

UNIT I

Classification of pathogenic microbes: Gram – negative, Spirochetes, Use of Microbiology, laboratory general principles - sputum, microbiologists, blood culture. Antimicrobial chemotherapy general principles - gentamycin, Cephalosporin, Antibiotic resistance, Protective efficacy of Ab molecule - Monoclonal antibiotics. Cryptococcus neoformans. Mycobacterium tuberculosis.

UNIT II

Medical Virology: Therapeutic control of hepatitis C virus. The role of neutralizing monoclonal antibodies, Antibodies for HIV treatment and prevention.

UNIT III

Medical Mycology : Introduction to medical mycology _ Fungi, dermatophytes, actinomycetes, mycelium, nocordia. Other actinomycetes infections _ Madurella, erythrism, conidia, phagocytic mechanisms in host response – Neutrophils, phagocytes and phagocytosis.

UNIT IV

Genetic disorders. Principles of identification of genetic disorders, Molecular Pathology of genetic diseases – globin genes, sickle cell anemia, thalessemias disease, tay sachs diseases, phenylkeutoneuria, lesch – nyhan syndrome, kallmann syndrome. Molecular genetics of diseases, genetic complexities of arteriosclerosis, gene contributing to diabetes mellitus

UNIT V

Gene products in medicine. Prokaryotic and eukaryotic cell in biotech production, Biopharmaceuticals expressed in plants, formulations of Biotech products, Somatic gene therapy, Advanced Biotechnology product and clinical development

TEXT BOOK:

1. Fungi pathogenic for humans and animals Dexter H.Howard, Lois F. Howard
Published by M.Dekker 1985
2. Pharmaceuticals biotechnology Drug Discovery and clinical applications. Oliver kayser, Rainer H, Muller Published by Wiley –VCH 2004

REFERENCE BOOK:

1. Microbiology in clinical practice, D.C.Shanson, Published by Wright, 1989, 2nd edition
2. Advances in Immunology: Vol 91, Fredick Walt Published by academic press 2006.
3. Human antibody therapeutics for viral disease series. Current topics in microbiology and immunology vol 317 Dessain, scott K, 2008.
4. Medical mycology the pathogenic fungi and the pathogenic actinomycetes,John Willard ripon, Published by saunders 1988 3rd edition

PROGRAMME	M.Sc. BIOTECHNOLOGY
SEMESTER	THREE
SUBJECT	LAB IN PLANT AND ANIMAL BIOTECHNOLOGY
COURSE CODE	15 MBT 305

1. Preparation of PTC medium
2. Callus induction and regeneration of shoot and roots.
3. Protoplast isolation and viability tests
4. Synthetic seed preparation
5. Culture and selection of Agrobacterium on Agar medium
6. Agro bacterium mediated gene transfer
7. Gus Assay
8. Synthesis of Gold nanoparticles from plants
9. Preparation of Animal cell culture medium
10. Filter sterilization by membrane filtration
11. Primary culture –chick embryo
12. Trypsinization and passaging
13. Viability cell counting- trypan blue assay
14. Extraction and analysis of phytochemical constituents from plants
15. Evaluation of antioxidant potential of plant extract (DPPH and ABTS Assay)

References:

1. Experimental Procedures in Life Sciences – Dr. S. Rajan and Mrs. R. Selvi Christy, Anjana Book House, 1st edition, 2010.

PROGRAMME	M.Sc. BIOTECHNOLOGY
SEMESTER	THREE
SUBJECT	LAB IN INDUSTRIAL AND ENVIRONMENTAL BIOTECHNOLOGY
COURSE CODE	15 MBT 306

1. Influence of Carbon and nitrogen source on any one industrial enzyme.
2. Identification of the organism producing amylase or protease.
3. Down stream processing of the protein.
4. Immobilization of cells
5. Production of Citric acid
6. Production of Ethanol/ wine
7. Preparation of Biofertilizer
8. Determination of total hardness Ca and Mg
9. Determination of BOD
- 10 Determination of COD

References:

1. Experimental Procedures in Life Sciences – Dr. S. Rajan and Mrs. R. Selvi Christy, Anjana Book House, 1st edition, 2010.

PROGRAMME	M.Sc.BIOTECHNOLOGY
SEMESTER	THREE
SUBJECT (SC)	BIO SAFETY AND BIOETHICS & IPR
COURSE CODE	

UNIT-I

Biosafety-Introduction. Different levels of biosafety. Guidelines for rDNA research activities. General guidelines for research in transgenic plants, Good Laboratory Practices (GLP). Containments- Types. Basic Laboratory and Maximum Containment Laboratory.

UNIT-II

Bioethics-Introduction. General issues related to environmental release of transgenic plants, animals and microorganisms. Ethical issues related to research in embryonic stem cell cloning.

UNIT-III

Introduction: Definitions. General Agreement on Trade and Tariff (GATT) and World Trade Organizations. Establishment and functions of GATT, WTO and WIPO. WTO Summits. Role of IBSC and RCGM. Physical and Intellectual Property.

UNIT-IV

TRIPS. Different types of intellectual property rights (IPR) - Patents, Trade mark, Trade secret Copy right, and Geographical indications. Biotechnological examples of patents, trademark, trade secret and copy right

UNIT-V

Patent application. Rules governing patents. Licensing - Flavr Savr™ tomato as a model case. Case studies on patents (Basmati rice, Turmeric, Neem, etc.). Indian Patent Act, 1970.

REFERENCES:

1. Recombinant DNA safety guidelines (January 1990), Department of Biotechnology, Ministry of Science & Technology, Government of India, New Delhi.
2. Revised guidelines for research in Transgenic plants (August 1998), Department of Biotechnology, Ministry of Science & Technology, Government of India, New Delhi.
3. Patents (2003), N.Subbaram, Pharma Book Syndicate, Hyderabad.
4. Molecular Biotechnology (1998), Second Edition, Glick, B.R., and Pasternack, J.J., ASM Press, Washington, DC.
5. Introduction to Plant Biotechnology (2001), H.S.Chawla, Oxford & IBH Publishing Co. Pvt. Ltd.

PROGRAMME	M.Sc. BIOTECHNOLOGY
SEMESTER	THREE
SUBJECT (SC)	ECOLOGY
COURSE CODE	

UNIT I

The Environment: Physical environment; biotic environment; biotic and abiotic interactions. Habitat and niche: Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement.

UNIT II

Population ecology: Characteristics of a population; population growth curves; population regulation; life history strategies (r and K selection); concept of metapopulation – demes and dispersal, interdemic extinctions, age structured populations. Species interactions: Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis.

UNIT III

Community ecology: Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones. Ecological succession: Types; mechanisms; changes involved in succession; concept of climax.

Unit IV

Ecosystem: Structure and function; energy flow and mineral cycling (CNP); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine). Biogeography: Major terrestrial biomes; theory of island biogeography; biogeographical zones of India.

UNIT V

Applied ecology: Environmental pollution; global environmental change; biodiversity-status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches. Conservation biology: Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves).

TEXT BOOK:

1. Principles of Ecology – Verma and Agarwal, Maxwell publication, 3rd edition, 1997.

REFERENCE BOOKS

1. Environmental biotechnology-S.K.Agarwal, TBH, 2nd Edition 1999.
2. Waste water engineering treatment and reuse-Metcalf&Eddy, Franklin L.Burton, H.David Stensel, 4th edition, Tata McGraw Hill publication. 2005

PROGRAMME	M.Sc.BIOTECHNOLOGY
SEMESTER	THREE
SUBJECT (SC)	ENVIRONMENTAL BIOTECHNOLOGY
COURSE CODE	

UNIT I

Applications of biotechnology in environmental management, Uses of GEM & microbes in environmental management, biosorption Bioremediation-types, factors, applications, bio augmentation, phyto remediation- types & applications, Bio remediation of xenobiotics

UNIT II

Biomining & applications, MEOR, biofuels by microbes-bioethanol,hydrogen production biotreatment for air pollution control –bio filters, bio scrubbers, biobed Solid waste management-sludge treatment, secure land fills, composting, methane production, thermal process-incineration, pyrolysis

UNIT III

Waste water treatment-characteristics of waste water, primary treatment-screening, equalization, flocculation, sedimentation, coagulation secondary treatment-biofilters-trickling filters

UNIT IV

Anaerobic biological treatment-contact digesters, packed bed reactors, UASB,membrane bioreactors, adsorption, disinfection immobilized cells in waste water treatment,

UNIT V

Aerobic biological treatment- activated sludge process, RBC, oxidation ponds, FBR, IFBBR biosensors in environmental monitoring biodegradable and ecofriendly products,

TEXT BOOKS:

1. Environmental biotechnology (Industrial pollution management) - S.N.Jogdand, 3rd edition, himalaya publication, 2004.

REFERENCES:

1. Environmental biotechnology-S.K.Agarwal, TBH, 2nd Edition, 1999.
2. Waste water engineering treatment and reuse-Metcalf&Eddy, Franklin L.Burton, H.David Stensel, 4th edition, Tata McGraw Hill publication, 2005.

SEMESTER – IV

PROJECT WORK AND VIVA VOCE

15 MBT 401

AREA OF STUDIES

Microbial Biotechnology, Animal and Plant Biotechnology, Environmental Biotechnology, Agricultural Biotechnology, Industrial Biotechnology, Biomedical Sciences, Bioinformatics, Bio nanotechnology and Herbal Technology.

1. The project has to be done in an organization and a certificate has to be obtained for the same from the organization concerned.
2. The project has to be done in any area relating to Biotechnology field.
3. The students may be instructed to follow the guidelines with regard to preparation of project writing.
4. The students are requested to present himself / herself for a review for two times which will be considered for internal evaluation.
5. The project would be evaluated and awarded a maximum of 160 marks in the internal and 40 marks in the external.

INTERNAL MARKS

Based on the project preparation marks should be awarded by the respective faculty guide giving weightage to the three aspects viz., the content (160), presentation (160) and viva voce (40).

EXTERNAL MARKS

The students have to present himself / herself for a viva voce along with the Project Report which will be conducted jointly by an internal and external examiner.