

SCHOOL OF LIFE SCIENCES

The Centre for Advanced Study in Botany, and the departments of Zoology, Biochemistry and Biotechnology together constitute the School of Life Sciences.

The first Science department of the University of Madras viz., the Department of **Zoology** was started in 1927 with Sir.K.Ramunni Menon as the honorary director. The department teaches and researches in the fields of, Cryopreservation of gametes and embryos of penaid prawns, Eye stalk neuropeptides and control of reproduction in the decapod crustaceans, Molecular aspects of reproduction in the decapod crustaceans, Biochemistry of spermatophores and seminal plasma in *Scylla serrata*, Biofouling: Environmental impact assessment, Water Quality, Viral diseases of shrimp Aquaculture of live food organisms, Mass culture of fairyshrimps and brine shrimps, Adaptations of cryptobiotic cysts of fairy shrimps and rotifers, Ultrastructure of fish parasites, Immunobiology of cultivable aquatic invertebrates, Physiology of respiratory pigments, Heavy metal regulation in arthropods, Cell surface glycoproteins, Cancer and free radical biology etc. Facilities are available to do research on the biological and biochemical aspects of animals. Sophisticated Instruments of the department are : EA - 940 Ion Analyser - Orion, SpeedVac, CM3 Cryomicroscope, Planer Biomed Kryo 10 (Programmable freezer), Revco Freezer, .Refrigerated Centrifuges, Metler Balance, Macrophor DNA Sequencing, PCR Machine, Standard Liquid Chromatography system , UV - Visible Spectrophotometersnos, Leica Binocular Microscope, Electrophoresis System, Gas Liquid Chromatograph, Phase - Contrast Microscope, Lyophilizer, Ultracentrifuge, HPLC, Gas Chromatography systems, L.S. Counter, ELISA Reader and Osmometer. The consultancy potentials of the department lie in the areas of Environmental impact assessment, Water Quality, Cryopreservation in crustacean embryos, Live feed for aquaculture, Health care of marine organism, Immunology of marine organism and Biochemistry of cancer. The department offers Master, M.Phil and Ph.D. programmes.

The department of **Botany** was started in 1929 for generating specialization in the field of Algology. In 1944 the emphasis shifted to Plant Pathology. In 1963 it was chosen for elevation as a Centre for Advanced Study by the University Grants Commission. Algology, Algal Biotechnology, Mycology, Fungal Biotechnology, Molecular plant Pathology, Environmental Microbiology, Plant Biotechnology and Genetic Engineering are the areas in which teaching and research are carried out by the department. The Centre is well equipped with modern sophisticated instruments. The Centre's Library has over 12,000 books on Plant Pathology, Microbiology, specialized topics and subscribes to nearly 25 Journals of International repute. A large collection of back volumes of journals is a treasure. The Centre maintains one of the largest culture collections in South Asia and about 800 algal, 500 fungal and a few bacterial strains are maintained. The Centre has an excellent field laboratory, situated at Maduravoyal, 10 kilometers away from Madras with all facilities to conduct field trials. The centre has sophisticated equipments like Atomic Absorption Spectrophotometer, Contamination Monitor, Electroporator, Electron Microscope - (Scanning and Transmission Electron Microscope), ELISA reader, Environmental Shakers, Fermentors, French Press, Gas Liquid Chromatography, Gel Eluter and Progenator, High Performance Liquid Chromatography, High Speed Centrifuges, Infra Red Gas Analyser, Liquid Scintillation Counter, Luminometers, Microfuges, Oxygen Monitor, PCR (Polymerase Chain Reaction) Unit, Personal computers, Photomicroscope, Scanning densitometer, Spectrofluorimeter, Spectrophotometers, Transilluminator, Ultracentrifuges, Ultramicrotome, Ultrasonicators, Vacuum freezer. The Centre offers consultancy on high technology for organic cultivation of cereals and vegetable crops, bio-fertilizers, bio-pesticides and biotechnological agents. Special training will be offered on high technologies to Industrialists, farmers, scientists and agriculturists, Mushroom production and mushroom compost, Bio-remediation and Bio - transformation of heavy metal pollution, Tannery effluent, dye factory effluent, Xenobiotics, radio- activity pollution and oil-pollution, Bio-remediation of polluted soils, are some areas in which frequent consultancy takes place. The department offers Masters, M.Phil. and Ph.D. programmes.

The department of **Biochemistry** was started in 1933 under the headship Dr.M.Damodaran to study Chemistry and Metabolism of proteins and enzymes. Since 1945, the department offers Masters, M.Phil and Ph.D. programmes. The department teaches and researches in the areas of Clinical Biochemistry, Cancer Biology, Standardization of Pharmaceuticals, Nutritional Biochemistry, De-addiction, Biochemical and Environmental Toxicology and Microbial Pathogenesis. The sophisticated equipments in the department are : Spectrophotometer, Liquid Scintillation Counter, Refrigerated High Speed Centrifuges and other instruments essential for biochemical investigations. The Department offers consultancy for Evaluation of drug efficacy and safety, Biochemical investigations for diagnosis, Anticancer studies, Narcotic addicts - Biochemical studies, Cardiotonic drugs, Respiratory and Gastro-intestinal infections, Hepatoprotective activity studies, Efficacy of

Ayurvedic drugs. The department was renamed as the Department of **Biochemistry and Molecular Biology** in 1998 and offers Masters programme in Molecular Biology.

The department of **Biotechnology** was started in 1997. The department offers Masters and Ph.D. Programmes.

Faculty

Dr.P.Ramasamy - Chairperson

Zoology

Dr.M.Arumugam, Ph.D. - Professor and Head
 Dr.H.Devaraj, Ph.D. - Professor
 Dr.P.S.Ramanibai, Ph.D. - Professor
 Dr.N.Munuswamy, Ph.D. - Professor
 Dr.P.Mullainadhan, Ph.D. - Reader
 Dr.M.Panneerselvam, Ph.D. - Lecturer

Centre for Advanced Study in Botany

N. Anand, Ph.D. - Professor and Director (Head)
 R. Balasubramanian, Ph.D. - Professor
 R. Rengasamy, Ph.D. - Professor
 J. Muthumary @ Kalaivani, Ph.D. - Professor
 P.T. Kalaichelvan, Ph.D. - Professor
 N. Raman, Ph.D. - Professor
 K. Murugesan, Ph.D. - Professor (on lien as COE)
 N. Mohan, Ph.D. - Lecturer
 P. Ebenezer, Ph.D. - Lecturer
 V. Kannan, Ph.D. - Lecturer
 V. Kaviyaran, Ph.D. - Lecturer
 K.Periyasamy, Ph.d. - Lecturer
 N.Mathivanan, Ph.D. - Lecturer
 P.Palani - Lecturer

Biochemistry

S. Niranjali Devaraj, Ph.D. - Professor and Head
 T. Devaki, Ph.D. - Reader
 S. Subramanian, Ph.D. - Lecturer
 G.Sudhandiram - Lecturer
 A.J.Vanisree - Lecturer

M.Sc. ADVANCED BIOCHEMISTRY

COURSE	COURSE TITLE	C/ E	L	T	P	C	COURSE DIRECTORS
I SEMESTER							
LIF C001	Biochemical Techniques	C	4	0	0	4	Dr. S. Subramanian &Dr.G.Sudhandiran
LIF C002	Biomolecules	C	4	0	0	4	Dr. A.J.Vanisree & Dr.G.Sudhandiran

LIF C003	Clinical Biochemistry – I	C	4	0	0	4	Dr.T.Devaki & Dr.A.J.Vanisree
LIF C004	Lab course in Biochemical Techniques	C	0	0	2	2	Dr. S. Niranjali Devaraj
LIF C005	Lab course in clinical Biochemistry	C	0	0	2	2	Dr.A. J. Vanisree
II SEMESTER							
LIF C006	Immunology – I	C	4	0	0	4	Dr. S. Subramanian
LIF C007	Metabolic Regulation	C	4	0	0	4	Dr. T. Devaki
LIF C008	Molecular Biology of the Gene	C	4	0	0	4	Dr. S. Niranjali Devaraj
LIF C009	Clinical Biochemistry – II	C	4	0	0	4	Dr.G.Sudhandiran& Dr.A.J.Vanisree
LIF C010	Lab course in Molecular Biology	C	0	0	2	2	Dr.S.Niranjali Devaraj
III SEMESTER							
LIF C011	Eukaryotic gene expression	C	4	0	0	4	Dr. S. Niranjali Devaraj
LIF C012	Immunology – II	C	4	0	0	4	Dr. S. Subramanian
LIF C013	Hormonal Regulation and Signal Transduction	C	4	0	0	4	Dr. T. Devaki & Dr.A.J Vanisree
LIF C014	Lab Course in Microbiology	C	0	0	2	2	Dr.G.Sudhandiran
IV SEMESTER							
LIF C015	Recombinant DNA Technology	C	4	0	0	4	Dr. S. Niranjali Devaraj Dr. G.Sudhandiran &Dr.A.J.Vanisree
LIF C016	Microbial approach to Biochemical and Pharmaceutical chemistry	C	4	0	0	4	Dr.A.J.Vanisree & Dr.G.Sudhandiran
LIF C017	Project: Dissertation & viva –voce	C	0	0	4+	6	All the faculty members

ELECTIVE COURSES FOR OTHER DEPARTMENTS

- LIF E001 Enzymes
- LIF E002 Experimental Induction and Diagnosis of Disease
- LIF E003 Macro and Micro Nutrients
- LIF E004 Basic Gene Therapy
- LIF E005 Metabolic Disorder
- LIF E006 Programming - PERL

LIF C001	Biochemical Techniques	C	4	0	0	4	Dr. S. Subramanian &Dr.G.Sudhandiran
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Electrophoresis, Chromatography & Centrifugation techniques; Microscopy, Spectroscopic and Mass spectrometric techniques; Electrochemical techniques; Cell culture, protein purification and Radioisotope techniques

LIF C002	Biomolecules	C	4	0	0	4	Dr. A.J.Vanisree & Dr.G.Sudhandiran
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Structure and functions of carbohydrates, proteins, lipids and nucleic acids

LIF C003	Clinical Biochemistry – I	C	4	0	0	4	Dr.T.Devaki & Dr.A.J.Vanisree
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Important endocrine glands and their secretions; Inborn errors of metabolism; Clinical enzymology; Structure and functions of the digestive system. Reproductive system; Composition and functions of blood, lymph and CSF; Nutritional requirements; Chemistry of respiration. Fluid, and acid base balance; Ca⁺⁺ and phosphate metabolism

LIF C004	Lab course in Biochemical Techniques	C	0	0	2	2	Dr. S. Niranjali Devaraj
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Isolation, Purification and Kinetics of Alkaline phosphatase; fractionation of Subcellular organelles and Assay of marker enzymes

LIF C005	Lab course in clinical Biochemistry	C	0	0	2	2	Dr.A. J. Vanisree
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Collection and preservation of blood and urine; Blood analysis, Assay of marker enzymes, Qualitative and quantitative analysis of urine, electrophoresis of serum proteins, LDH isozymes

LIF C006	Immunology – I	C	4	0	0	4	Dr. S. Subramanian
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Introduction and Definition; Lymphoid Organs; Cells of the immune system; Antigens; Antibody; Antigen - Antibody Reactions; tumor immunology

LIF C007	Metabolic Regulation	C	4	0	0	4	Dr. T. Devaki
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Metabolic flux; Glycolysis & Gluconeogenesis; Glycogen Metabolism and its regulation; Electron Transport Chain; Fatty acid metabolism; Nitrogen Metabolism;. Heme Metabolism; Integration of metabolism

LIF C008	Molecular Biology of the Gene	C	4	0	0	4	Dr. S. Niranjali Devaraj
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DNA replication and repair; Prokaryotic gene expression; Regulation of prokaryotic gene expression; Recombination and mobile genetic elements; Cell cycle and growth regulation

LIF C009	Clinical Biochemistry – II	C	4	0	0	4	Dr.G.Sudhandiran& Dr.A.J.Vanisree
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Free Radicals; lipid peroxidation and antioxidants; essential nutrients as antioxidants. Structure and functions of central nervous system, liver kidney; Muscle; Diseases of the immune system; Molecular aspects of drug action.

LIF C010	Lab course in Molecular Biology	C	0	0	2	2	Dr.S.Niranjali Devaraj
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Isolation of plasmid DNA; Genomic DNA extraction; Restriction analysis;; Preparation of competent *E. coli*, PCR; blotting techniques; Southern blot and hybridization

LIF C011	Eukaryotic gene expression	C	4	0	0	4	Dr. S. Niranjali Devaraj
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The eukaryotic genome; Eukaryotic Transcription; RNA processing; Post-and Co-translational modification of proteins; Oncogenes and cancer (Molecular Mechanisms)

LIF C012	Immunology – II	C	4	0	0	4	Dr. S. Subramanian
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Complement; Hypersensitivity; Auto immune Disease; Transplantation; Immunological Techniques; Immunity and Malnutrition; Immunization

LIF C013	Hormonal Regulation and Signal Transduction	C	4	0	0	4	Dr. T. Devaki & Dr.A.J Vanisree
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Hormone Action and receptors; Guanine nucleotide binding proteins as signal transducers; Cyclic nucleotides as second messengers; Inositol lipids in signal transduction; Ca²⁺ and cellular regulation; Mechanism of Action of Insulin and Growth factors; Mechanism of action of steroid hormones.

LIF C014	Lab Course in Microbiology	C	0	0	2	2	Dr.G.Sudhandiran
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Preparation, sterilization and inoculation of media – Maintenance and identification of microbes, biochemical characterization and sub culturing techniques – Staining techniques – Isolation of microorganisms from air, water, and oil samples – Antibiotic sensitivity of microbes, use of antibiotic discs – Microbial production of amylase, protease, alcohol and citric acid – assay of vitamins – Riboflavin

LIF C015	Recombinant DNA Technology	C	4	0	0	4	Dr. S. Niranjali Devaraj Dr. G.Sudhandiran & Dr.A.J.Vanisree
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Basic techniques; Cloning strategies; cDNA and Genomic DNA libraries; Introduction of genes into animal cells; Agro bacterium; Applications of recombinant DNA technology.

LIF C016	Microbial approach to Biochemical and Pharmaceutical chemistry	C	4	0	0	4	Dr.A.J.Vanisree & Dr.G.Sudhandiran
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Structure of bacteria, fungi and viruses and their classification; Microbial fermentation Microbial degradation of products of aerobic and anaerobic growth; Manufacture of bread, malt beverages, wine, vinegar, pickle, cheese and idli, pressed food and fodder yeast.

LIF C017	Project: Dissertation & viva –voce	C	0	0	4+	6	All the faculty members
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M.Sc. BIOINFORMATICS

Subject Code	Title of the Course	Core/ Elective	L	T	P	C
SEMESTER I						
LIF C101 LIF C102	*Basic Biology / Introduction to Mathematical Methods	C	3	0	0	3
PHY C102	Principles of Macromolecular Structure and Function	C	4	0	0	4
LIF C103	Biological Chemistry	C	4	0	0	4
LIF C104	Introduction to Computing	C	4	0	0	4
LIF C105	Practical I – Lab Course in Biochemistry	C	0	0	2	2
SEMESTER II						
LIF C106	Molecular Biology	C	4	0	0	4
LIF C107	Introduction to Database systems	C	4	0	0	4
LIF C108	Practical II – Lab Course in Molecular Biology	C	0	0	2	2
LIF C109	Practical III – Computer Programming	C	0	0	4	4
SEMESTER III						
LIF C110	Genomics and Proteomics	C	4	0	0	4
LIF C111	Algorithms in Bioinformatics	C	4	0	0	4
LIF C112	Biomolecular Modeling and Computer-Aided Drug Design	C	4	0	0	4
LIF C116	Practical IV Biomolecular Structure and Analysis	C	4	0	0	4
LIF C113	Practical V – Sequence and structure analysis	C	0	0	4	4
SEMESTER IV						
LIF C114	Project	C				4
LIF C115	Viva	C				2

Elective for other Departments

LIF E105	Programming - PERL
LIF E102	Recombination DNA Technology

SEMESTER I

LIF C101 / LIF C102	*Basic Biology / Introduction to Mathematical Methods	C	3	0	0	3	LIF C101 / LIF C102
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The Origin of Life-Evolution, Mendelian Genetics, Bacteria-Morphology, Fine structure, recombination, gene mapping, Viruses-plant and animal viruses, life cycle, Plant diversity, Animal life - Co-ordinate geometry, Trigonometric functions, Vectors and matrices, Calculus: Differentiation and Integration, Set theory, Fourier series and transforms.

PHY C102	Principles of Macromolecular Structure and Function	C	4	0	0	4
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Stereochemistry and concept of conformation, Principles of protein structure, Levels of organization of polypeptide chains, Structure of fibrous proteins, Structure and function of globular proteins, protein folding, Principles of nucleic acid structure, DNA polymorphism, Structure of DNA and RNA, Principles of polysaccharide structure, Structure of macromolecular assembly.

LIF C103	Biological Chemistry	C	4	0	0	4
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Thermodynamic concepts, Enzymes, Mechanism of Enzyme action, Enzyme kinetics, allosteric enzymes, Amino acids and proteins, Nucleic acids, Structure and function of carbohydrates, Structure and function of lipids, Metabolic pathways, Basic Immunology – Innate and acquired immunity, Antibody structure and function, MHC I, MHC II, Autoimmunity, Vaccines.

LIF C104	Introduction to Computing	C	4	0	0	4
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Elements of a computer processing system, Telecommunications and Network technologies, Basics of Internet and the World Wide Web, HTML, Multimedia - UNIX / LINUX, Ms-WINDOWS, Programming in C

LIF C105	Practical I – Lab Course in Biochemistry	C	0	0	2	2
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Isolation and Purification of proteins - Ammonium sulphate fractionation, Gel permeation chromatography, Ion-exchange chromatography, SDS-PAGE, Electro elution. Immunological techniques - Western blotting, ELISA, Immunodiffusion, Immunoelectrophoresis

LIF C106	Molecular Biology	C	4	0	0	4
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Prokaryotes versus eukaryotes, DNA replication, repair, recombination and transposition. Transcription, Translation, Protein sorting, degradation, Cell to cell signaling, Cell cycle, Cancer and apoptosis, Membrane Biology.

LIF C107	Introduction to Database systems	C	4	0	0	4
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Basic concepts of different Data models, SQL, Data warehousing, Data capture, Data analysis, Primary protein sequence Database, Composite protein sequence Databases, Structure classification Databases, Proteomic Databases, DNA sequence Databases, Micro array Database, Metabolic Database.

LIF C108	Practical II – Lab Course in Molecular Biology	C	0	0	2	2
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Isolation of genomic and plasmid DNA, Agarose gel electrophoresis of Nucleic acids, PCR, Restriction Digestion, Ligation, Transformation.

Demonstration : 2D electrophoresis, Isoelectric focusing, DNA sequencing

LIF C109	Practical III – Computer Programming	C	0	0	4	4
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Basics of MS-DOS, Unix, Linux and Windows operating system, Development of at least 20 programs in C and C++.

LIF C110	Genomics and Proteomics	C	4	0	0	4
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Structure and Organisation of prokaryotic and Eukaryotic genomes, Comparative Genomics, Genomics Tools, Human Genome Project, Transcriptome analysis, Proteomics and its applications, Tools of Proteomics

LIF C111	Algorithms in Bioinformatics	C	4	0	0	4
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Algorithms-computational complexity, Pairwise sequence alignment, BLAST, FASTA, Markov chains, Hidden Markov models, Multiple sequence alignment, Genetic algorithm, Secondary structure prediction, Threading, Predicting 3D structure, homology modeling, Ab-initio prediction, Phylogenetic analysis

LIF C112	Biomolecular Modeling and Computer-Aided Drug Design	C	4	0	0	4
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Basic concepts, force fields, energy minimization algorithm, Monte-Carlo simulation, Ab initio and semi empirical methods, Computer aided drug design, QSAR, 3D database searching, Pharmacophore modeling and novel drug design, Cheminformatics, Molecular docking, Use of genomics and proteomics for understanding diseases at molecular level, strategies for target identification and lead design.

LIF C116	Practical IV Biomolecular Structure and Dynamics	C	0	0	4	4
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Tools - Protein sequence analysis, Molecular Graphics and Evaluating protein structure, Free energy calculations, Calculation of phi-psi angles, Ramachandran plot, Representation of helical parameters using dial and windows, 3D structures of proteins and nucleic acids.

LIF C113	Practical V – Sequence and structure analysis	C	0	0	4	4
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Analysis of protein and nucleic acids sequences, FASTP, FASTN, Multiple alignment programs, Development of programs in the analysis of nucleic acid sequences, Small molecule generation and Assessment, Molecular Docking, Programs to calculate potential energy of regular structures

LIF C114	Project	C				4
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LIF C115	Viva	C				2
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ELECTIVE COURSES OFFERED FOR OTHER DEPARTMENTS AND DEPARTMENT OF BIOCHEMISTRY

COURSE CODE	COURSE TITLE	COURSE DIRECTORS	CREDITS
SEMESTER I			
LIF E001	Enzymes	Dr. S. Niranjali Devaraj	3
SEMESTER II			
LIF E002	Experimental induction and Diagnosis of diseases	Dr. S. Subramanian	3
LIF E003	Macro and Micro Nutrients	Dr.A.J.Vanisree & Dr.G.Sudhandiran	3
SEMESTER III			
LIF E004	Basics of Gene therapy	Dr. S. Niranjali Devaraj	3

ELECTIVES OFFERED FOR DEPARTMENT OF BIOCHEMISTRY ONLY

COURSE CODE	COURSE TITLE	COURSE DIRECTORS	CREDITS
SEMESTER II			
LIF E005	Metabolic disorders	Dr. T. Devaki	3
SEMESTER III			
LIF E006	Programming in Perl	Guest Faculty	3

ELECTIVE COURSES OFFERED FOR OTHER DEPARTMENTS AND DEPARTMENT OF BIOCHEMISTRY

LIF E001	Enzymes	Dr. S. Niranjali Devaraj	3
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Active site, Determination of amino acids at active site, Mechanism of action of enzymes, Importance of enzyme kinetics, kinetics of single-substrate reactions; Michaelis-Menten kinetics, Determination of K_m and v_{max} , catalytic efficiency, turnover number, Lineweaver-burk plot and Eadie hofstee plot, factors influencing enzyme activity, effect of pH, temperature, substrate concentration, enzyme induction, enzyme inhibition, allosteric regulation.

LIF E002	Experimental induction and Diagnosis of diseases	Dr. S. Subramanian	3
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Selection of animal model, routes of administration of drugs, induction of diabetes, ulcer, arthritis, cardiovascular and hepatic diseases, cancer. Diagnostic markers for various diseases.

LIF E003	Macro and Micro Nutrients	Dr.A.J.Vanisree & Dr.G.Sudhandiran	3
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Introduction to nutrition, nutrients, types; macronutrients; carbohydrates, proteins, lipids. Functions, source. Deficiency manifestations; RDA. Definition; Role of micronutrients; vitamins; fat & water soluble, dietary

requirements, deficiency states and dietary source. - Definition, role of trace elements Ca,P,Mg,Zn,Se,Cu,Mn,Na,K, Cl; deficiency states, dietary source and RDA .

LIF E004	Basics of Gene therapy	Dr. S. Niranjali Devaraj	3
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Introduction, Viral and non-viral vectors, Gene therapy in the clinic-human trials, gene therapy for cancer, anti- sense therapy, Ethical issues in gene therapy, prospects of gene therapy, new developments in gene therapy.

ELECTIVES OFFERED FOR DEPARTMENT OF BIOCHEMISTRY ONLY

LIF E005	Metabolic disorders	Dr. T. Devaki	3
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Alterations of metabolic pathways in diseases with special reference to Diabetes, lipo2proteinemia, gout aminoaciduria, ketosis

LIF E006	Programming in Perl	Guest Faculty	3
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Introduction, Working with Strings and Numbers(Scalar Data), Operators, Lists and Arrays, Hashes, Conditionals and Loops, Pattern Matching with Regular Expressions, Debugging Perl, Files and I/O.

M.Sc., BIOTECHNOLOGY

Course Code	Course Title	C/E/Ss	Credits				Course Faculty
			L	T	P	C	
IST SEMESTER							
LIF C201	Biochemistry	C	4	0	0	4	Biochem./GF
LIF C202	Molecular Genetics	C	4	0	0	4	Botany/ G.V.
LIF C203	Lab Course in Molecular Genetics	C	0	0	2	2	Botany/ G.V.
LIF C204	Microbiology	C	4	0	0	4	Botany/ K.U
LIF C205	Molecular Cell Biology	C	4	0	0	4	P.R.
LIF C206	Lab Course in Molecular Cell Biology	C	0	0	2	2	P.R.
LIF E201	Molecular and Developmental Biology	E	3	0	0	3	Dr.Shyamala
LIF E202	Molecular Parasitology	E	3	0	0	3	P.R.
LIF C207	Lab Course in Analytical Biochemistry	C	0	0	2	2	GF/K.U.
LIF E203	Basic Cell Biology	E	3	0	0	3	P.R.
IIND SEMESTER							
LIF C208	Enzymology and Enzyme Technology	C	4	0	0	4	G.V.
LIF C209	Animal Cell Biotechnology	C	4	0	0	4	Dr.Shyamala
LIF C210	Lab Course in Animal Cell Biotechnology	C	0	0	2	2	P.R./GF
LIF C211	Cloning Vectors	C	4	0	0	4	P.R./GF
LIF E204	Genomics and Proteomics	E	3	0	0	3	GF
LIF C212	Microbial Technology	C	4	0	0	4	K.U.
LIF E205	Tissue Engineering	E	3	0	0	3	GF.
LIF C213	Plant Biotechnology	C	4	0	0	4	CASin Botany/GF
LIF C214	Lab Course in Bioprocess and Genetic Engineering	C	0	0	2	2	All faculty
LIF E206	Basic Biotechnology	E	3	0	0	3	P.R.
LIF E207	Basic Molecular Biology	E	3	0	0	3	K.U.
IIIRD SEMESTER							
LIF C215	Genetic Engineering	C	4	0	0	4	P.R./GF
LIF C216	Lab Course in Genetic Engineering	C	0	0	2	2	P.R./GF
LIF E208	Immunotechnology	E	3	0	0	3	GF/Dr. R.E.B.Hanna
LIF E209	Gene Technology	E	2	1	0	3	P.R./GF
LIF C217	Lab Course in Plant Biotechnology	C	0	0	2	2	GF
LIF E210	Basic Enzyme Technology	E	3	0	0	3	G.V.

Course Code	Course Title	C/E/Ss	Credits				Course Faculty
			L	T	P	C	
IV TH SEMESTER							
LIF C218	Marine Biotechnology	C	4	0	0	4	Dr.Shyamala
LIF E211	Environmental Biotechnology	E	3	0	0	3	G.V.
LIF E212	Biosensors	E	3	0	0	3	GF.
LIF C219	Dissertation and Viva-Voce	C	0	0	3+2	5	All Faculty/ University-Industry/Institutes Interactions

LIF C201	Biochemistry	4	0	0	4	Guest Faculty
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Unit I

Structure, chemistry and properties of carbohydrates; lipids; and proteins:

Definition, nomenclature, classification, structure, chemistry and properties of carbohydrates; lipids; amino acids, peptides and proteins; purines and pyrimidines, nucleosides, and nucleotides and poly-nucleotides; Methods for isolation & characterisation of proteins; chemical synthesis of peptides; study of specific proteins like hemoglobin, myoglobin and plasma proteins.

Unit II

Classification of porphyrins, their structure and properties; structure of metalloporphyrins- haeme and chlorophyll; Vitamins and Hormones.

Unit III

Principles of Bio-energetics; Metabolism of carbohydrates, fats, proteins, purines & pyrimidines-their biosynthesis & degradation; structure of mitochondria, organisation of respiratory chain, mechanism of oxidative phosphorylation & its inhibitors, structure of chloroplast and photo phosphorylation, urea cycle; hormonal regulation of mammalian metabolism. P-type ATPases- F-type ATPase- V-type ATPases- Cell biology and pathobiology of ATPases and their compartments

Unit IV

Biological membranes and transport: cytoskeletal organisation; Prostaglandins, leukotrienes, thromboxanes; interferons & interleukins; antibodies; alkaloids; plant & animal pigments.

Unit V

Separation methods:

chromatography- paper, adsorption, ion-exchange, thin layer, gas, reverse phase & affinity chromatography, high-performance liquid chromatography; gel filtration; electrophoreses-moving boundary, paper, starch, agarose; and polyacrylamide gel electrophoresis (PAGE & SDS PAGE); disc & slab gel electrophoresis; 1D & 2D electrophoresis & immunoelectrophoresis, high voltage electrophoresis & isoelectric focussing. Isolation methods-tissue slice technique; tissue homogenate; cell fractionation by differential centrifugation; ultra-centrifugation (preparative & analytical); density gradient centrifugation.

LIF C202	Molecular Genetics	4	0	0	4	Dr. G. Vijaiyan Siva
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Unit I

Gene as a unit of mutation and recombination

Identification of DNA as a genetic material Mutation: Molecular nature, chemical mutagenesis by nitrous acid, hydroxylamine, alkylating agents, intercalators and Physical mutation by UV, origin of spontaneous mutation and its control, DNA damage and repair: Chemical and physical agents and cross-linkers - Mechanism of repair: Photo reactivation, excision repair, recombinational repair - The SOS and adaptive responses and their regulation - Heat shock response.

Unit II

Parasexual processes in bacteria: transformation, transduction and conjugal gene transfer: their phenomena, mechanisms and applications.

Unit III

Fine structure of the gene: Analysis with examples .Recombination, controls models and explanation - Gene as the unit of expression - Colinearity of the gene and polypeptide - Elucidation of the genetic code - Wobble base pairing - Suppression of nonsense, missense and frame shift mutations - Regulation of gene expression - The Operon concept, positive, negative and attenuation control - Control sequences: promoter, operator, terminator and attenuator.

Unit IV

Extrachromosomal heredity: Biology of plasmids, their discovery, types and the structure of F, RTH, *col* factors and Ti - Replication and partitioning - Incompatibility and copy number control - natural and artificial plasmid transfers and their applications.

Transposable genetic elements: Discovery - Early experiments of McClintock in Maize - Insertion sequences in prokaryotes - Complex transposons (ex. Tn10, Tn5, Tn9 and Tn3) - Mechanisms, control, consequences and application of transposition by simple and complex elements.

Unit V

Genetics of eukaryotes: gene linkage and chromosome mapping - Crossing over, three point cross, tetrad analysis - Complementation - Organisation of chromosomes and specialised chromosomes - Chromosome abnormalities; Quantitative inheritance - Population genetics - Developmental genetics using *Drosophila* as a model system - Somatic gene analysis.

LIF C203	Lab Course in Molecular Genetics	0	0	2	2	Dr. G. Vijaiyan Siva
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Single colony isolation and checking for genetic markers - Measurement of growth rate and determination of the growth curve using a 7 phage - Induced mutagenesis and isolation of antibiotic resistant and auxotrophic strains - Enrichment methods for auxotrophic and antibiotic resistant mutants - genetic mapping by p1 transduction, conjugation - isolation of specialised transducing phages - transducing phages - transposon mutagenesis of chromosomal DNA - transposon mutagenesis of plasmid DNA -Experiments with gene fusion.

LIF C204	Microbiology	4	0	0	4	Ms. K.Umamaheswari
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Unit I

History and Scope of Microbiology - Milestones in Microbiology - Recent developments and future trends. Basic Microbiology-Anatomy of Prokaryotes and Eukaryotes - Morphology - Ultra structure of Bacteria, Fungi, Algae, Protozoa and Viruses - structure and functions of the cellular components. Physiology - Growth and nutrition - nutritional requirements- kinetics of growth - media and culture. Systematics and taxonomy - Classification of microbes - Phenotypic and taxonomic characters - Principles of classification - taxonomic structure - DNA analysis, Ribosomal RNA analysis- Numerical taxonomy - Molecular taxonomy - methods of microbial identification.

Unit II

Applied Microbiology: Environmental Microbiology - Microbial ecology - role of micro-organisms in the productivity of ecosystems - Interactions between micro organisms, and with plants and animals - microbes and biodeterioration - microbes in waste treatment.

Unit III

Medical Microbiology -Pathogenic microbes - Bacterial, Viral, Fungal and Protozoan diseases. Cure, control and prevention-Food and Dairy Microbiology - Microbes in food-Role of Micro-organisms in food production; dairy and non-dairy products-fermented foods and alcoholic beverages.

Unit IV

Industrial Microbiology- Industrial use of microbes - fermentation products - bioconversions - bioremediation. products of industrial microbiology. Penicillin, ethanol, vinegar, vitamin B12, citric acid, glutamic acid, protease etc.

Unit V

Microbiology and Biotechnology-Biotechnological potentials of microbes-production of food (single cell protein), Fuel (ethanol), Pharmaceuticals (antibiotics, vaccines etc), biofertilisers (BGA), Biopesticides (*Bacillus thuriensis*), biopolymers, biosurfactants etc. Biology of micro-organisms of importance and use in Biotechnology -*Streptomyces*, yeasts (*Saccharomyces*, *Hansenula*), *Spirulina* and *Penicillium* etc.- Disposal of Microbes and biosafety-Environmental Microbiology Bioremediation.

LIF C205	Molecular Cell Biology	4	0	0	4	Prof. P. Ramasamy
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Unit I

The dynamic cell-the molecules of life-the architecture of cells-Protein structure and function-Hierarchical structure of proteins-folding, modification, and degradation of proteins- functional design of proteins-membrane proteins-purifying, detecting, and characterizing proteins

Unit II

Nucleic acids, the genetic code, and the synthesis of macromolecules-structure of nucleic acids-synthesis of biopolymers-nucleic acid synthesis-the three roles of RNA in protein synthesis-stepwise formation of proteins on ribosomes. Biomembranes and the subcellular organization of eukaryotic cells-microscopy and cell architecture-purification of cells and their parts-biomembranes-organelles of the eukaryotic cell.

Unit III

Molecular structure of genes and chromosomes-molecular definition of a gene-chromosomal organization of genes and noncoding DNA-mobile DNA-functional rearrangements in chromosomal DNA-organizing cellular DNA into chromosomes-organelle DNAs. Regulation of transcription initiation-bacterial gene control-bacterial transcription initiation-Eukaryotic gene control-regulatory sequences in eukaryotic protein-coding genes-eukaryotic transcription activators and repressors-RNA polymerase II transcription-Initiation complex. Regulation of gene expression in eukaryotic systems; Hormones and gene expression; Viruses and gene expression; Growth factors; Mitogens and oncogenes;

Unit IV

RNA processing-nuclear transport and post-transcriptional control-DNA replication-repair-recombination-Regulation of the eukaryotic cell cycle-Gene control in development-transport across cell membranes-cellular energetics-glycolysis-aerobic oxidation-photosynthesis-protein sorting-organelle biogenesis-protein secretion-cell motility and shape I-microfilaments-cell motility and shape II-microtubules and intermediate filaments-cell-to-cell signaling-hormones and receptors-cell interactions in development.

Unit V

Brief introduction to the life cycle and molecular biology of some important pathogen of AIDS, Malaria, Hepatitis , Tuberculosis, Filaria, Kalaazar.

LIF C206	Lab Course in Molecular Cell Biology	0	0	2	2	Prof. P. Ramasamy
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Microscopy:Bright field, Phase contrast & Fluorescence microscopy; microtomy, Instrumental methods for cell biology; subcellular fraction and marker enzymes; Histochemical methods; mitosis and meiosis. Preparation of metaphase chromosomes from cultured cells; Isolation of DNA and demonstration of apoptosis of DNA laddering; MTT assay for cell viability and growth; Cell fusion with PEG.

LIF E201	Molecular and Developmental Biology	3	0	0	3	Dr. Shyamala
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Unit I

Molecular aspects of cell division and cell cycle; cell fusion: Nuclear-Cytoplasmic interaction

Unit II

Regulation of gene expression in eukaryotic systems: Hormones and gene expression; Viruses and gene expression; Transcriptional and translational controls.

Unit III

Growth factors: Mitogens and oncogenes;

Unit IV

Cellular regulation, development and differentiation. Gene control in development: myogenesis in mammals-neurogenesis in *Drosophila* and *Mice*-

Unit V

Regional specification in *Drosophila* Embryogenesis-Mammalian homologs of in *Drosophila* ANT-C and BC-X

LIF E202	Molecular Parasitology	3	0	0	3	Prof.P.Ramasamy
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Unit I

Introduction to Parasitology: Definition of parasitism - Parasitology and Human Welfare -Symbionts - Mutualism - Commensalism - Parasitism - Hosts - Biotic potential of parasites - Parasite distribution and density - Ecology of parasitic infections- Effects on human welfare.

Unit II

Intimate associations between organisms - Structural aspects of the association interface - Molecular biology of Nutrient exchanges in association - Physiological (reproduction, intermediate metabolism) and regulatory interactions -Drug design.

Unit III

Protozoan parasites- Scale of infections-Strategies for survival *Entamoeba histolytica*-*Giardia lamblia*-*Trypanosoma (Trypanozoon) brucei brucei* - *Trypanosoma brucei gambiense*- mitochondrial genes; cytochrome oxidase II and III- mechanism; the 'editosome'- guide RNAs; structural features and maxi/mini-circle origin- the trypanosome coat and variant surface glycoproteins- membrane anchorage of the VSG by glycosylphosphatidylinositol (GPI)- the GPI anchor as a drug target- chromosome size classes and VSG gene locations - *Leishmania tropica* -

Unit IV

Protozoan parasites -*Plasmodium falcifarum*-Morphology and life history -Molecular Pathology – Pathogenesis – control of disease; introduction to chemotherapy and vaccines- Diagnosis and treatment- antigen genes/protein structure- glutathione S-transferase as antigen and enzyme-subversion of the immune system- importance of T cell responses; T cell epitopes- genetic and structural basis of resistance to antifolate drugs- glycosomes and targeting of the glycolytic enzymes

Unit V

Platyhelminths –Molecular biology of Monogenea –Trematoda - Digenea – Cestoidea – form, function of the tapeworms of particular importance to humans – Schistosomes-Ascaridata – large intestinal roundworms – pinworms – filarial worms – tongue worms.

Parasitic crustaceans – Parasitic insects – the fleas – the ticks and mites-drugs and treatment.

LIF C207	Lab Course in Analytical Biochemistry	0	0	2	2	Ms.K.Uma Maheswari
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Colorimetry, Spectrophotometry and pH meters & buffers: Their theory and application . Protein estimations: Lowry and Bradford methods.

Chromatography: A theoretical study of Gel filtration chromatography, Ion-exchange chromatography, Affinity chromatography, Thin layer chromatography (TLC), High performance liquid chromatography and Gas liquid chromatography and their demonstration.

Screening and identification of industrially important micro-organisms - Production of an extracellular enzyme from the yeast and down stream processing-Ammonium sulphate precipitation/ ultrafiltration-Dialysis-ion-exchange, gel permeation etc. - Polyacrylamide gel electrophoresis.

Use of radioactivity in biochemistry: Radioactive labelling tracer techniques, measurement of radioactivity and autoradiography (Demonstration).

LIF E203	Basic Cell Biology	3	0	0	3	Prof. P.Ramasamy
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Unit I

Cell: The dynamic cell-the molecules of life-the architecture and types of cells-cells into tissues. Biomembranes, transport across cell membranes- subcellular organization of eukaryotic cells- microscopy and cell architecture.

Unit II

Genetic code and the synthesis of macromolecules: structure of nucleic acids- nucleic acid synthesis- DNA replication-repair-recombination - protein secretion and sorting, folding, modification, and degradation of proteins.

Unit III

Recombinant DNA and genomics: DNA cloning with plasmid vectors- identifying, analyzing and sequencing cloned DNA- bioinformatics-polymerase chain reaction-DNA microarrays.

Unit IV

Molecular structure of genes and chromosomes: Regulation of transcription in bacteria and eukaryotic cell. RNA processing and post-transcriptional control.

Unit V

Cell cycle- cellular energetics- cell motility -cell-to-cell signaling-hormones and receptors.

LIF C208	Enzymology and Enzyme Technology	4	0	0	4	Dr. Vijaiyan Siva
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Unit I

Enzyme nomenclature and classification: General properties of enzymes and the factors that affect their activity and the associated changes; Extraction assay and purification of enzymes.

Unit II

Enzyme kinetics: (steady state), determination of Km value and studying kinetics using Lineweaver-Burke plot, Eadie-Hofstee plot and Hans-Woolf equations -Enzyme inhibitors-Presteady state kinetics-fast kinetics to elucidate the intermediate and rate limiting steps(flow and relaxation techniques); Complex kinetics and analysis; Enzyme inhibitors.

Unit III

Enzyme specificity: Evidences for enzyme substrate complex-Nucleophilic and Electrophilic attack - Role of metal ions in enzyme catalysis ; Mechanism of enzyme action-(lysozyme,chymotrypsin), DNA polymerase, RNase etc.-zymogens and enzyme activators, active site determination.

Unit IV

Regulation of enzymes: Allosteric interactions and product inhibition; Coenzymes, Isoenzymes & metalloenzymes; Membrane bound enzymes-their extraction assay, lipid-protein interaction, and the effect of fluidity on enzyme activity.

Unit V

Clinical and Industrial Applications of Enzymes: Immobilization of enzymes-Enzyme engineering.

LIF C209	Animal Cell Biotechnology	4	0	0	4	Dr.Shyamala
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Unit I

History of animal Biotechnology: Basic principles of Biotechnology as applicable to animal Science-Artificial Insemination, pregnancy diagnosis, In-vitro fertilization -Embryo Transfer Technology-Transgenic Animals.

Unit II

Animal Health-Disease Diagnosis: Hybridoma Technique, Monoclonal antibodies, application of Probes for diagnosis of existing and emerging Animal diseases. Prophylaxis-Vaccines-Modern biotechnology Oriented Vaccines-DNA Vaccines in Animal Disease.

Unit III

Enabling Cell culture Technologies: Setting up a new cell culture laboratory-Adaptation of mammalian cells to growth in serum-free media-Viral evaluation of animal cell lines used in Biotechnology-Optimizing gene expression in mammalian cells- Recombinant cells -Immortalization strategies for mammalian cells-Mouse monoclonal antibodies: Cell Bank preparation and characterization: DNA fingerprinting and characterization of animal cells-Cell counting and viability measurements-animal cell growth and productivity-Measurement of cell death in culture

Unit IV

Nuclear magnetic resonance methods of monitoring cell metabolism: Culturing animal cells in Fluidized bed reactors-Anchored fusion proteins-Harvesting GPI-Anchored proteins from CHO cells-Hematopoietic Cells for cellular and gene therapy.

Unit V

Basic assay techniques: Hematopoietic Cells for cellular and gene therapy: Cytotoxicity testing using cell lines-Measuring the folding dynamics of recombinant proteins secreted from mammalian cells- proteolysis in cell culture: application of engineered cell lines- recombinant glycoprotein heterogeneity.

LIF C210	Lab Course in Animal Cell Biotechnology	0	0	2	2	Prof. P. Ramasamy
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Preparation of tissue culture medium and membrane filtration; preparation of single cell suspension from spleen and thymus; Cell counting and cell viability; Macrophage monolayer from PEC and measurement of phagocytic activity; Trypsinization of monolayer and subculturing; Cryopreservation and thawing; Measurement of doubling time; Role of serum in cell culture;

LIF C211	Cloning Vectors	4	0	0	4	Prof. P.Ramasamy
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Unit I

Genome: Replication - Transcription - Translation in prokaryotes and Eukaryotes- Recombination and repair-Restriction Endonucleases - properties - functions - ligation of DNA fragments-transformation techniques.

Unit II

Vectors: E.Coli vectors - Plasmid biology - pBR 322 and its derivatives - gene markers-Cloning vectors for gram-negative bacteria & phage - filamentous phages - Cosmid - phasmid-Cloning in Gram - Positive bacteria *Bacillus subtilis* .

Unit III

Plant cloning vectors: *Agrobacterium tumefaciens* - Ti plasmids - molecular genetics and gene expression-
Animal cell cloning vectors - Baculoviruses - mammalian expression vectors - retroviral vectors-Expression vectors - vectors for fusion protein - promoters - translation - proteases .

Unit IV

Gene fusion - secretion - modification and protein refolding: inducible/constitutive expression cassettes-Subcloning of genes - vectors for sub cloning - Identification of rDNA-Impact of gene cloning and Bioethics.

Unit V

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

LIF E204	Genomics and Proteomics	3	0	0	3	Guest Faculty
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Unit I

Genomic and cDNA sequences: output management from different biological output sources, gene prediction rules and software- Human Genome Project – Mutations, Population studies.

Unit II

Gene therapy: Analysis of genomic and proteomic information with respect to biological systems – Genome Applications- Transgenic animals and plants-Pathway regulatory networks. **Drug design /discovery** and identification, synthesis of new drugs; Management of diverse chemical libraries.

Unit III

Gene Expression: Microarrays and recent developments in expression analysis: Genes; Oncogenes – protooncogenes – Classification of Cancer Types: Applications of Microarrays in Drug Toxicity Testing, Metabolic pathways.

Unit IV

Sequence Analysis (Proteins & Nucleic acids) Sequence Alignment methods- Proteomics: Proteins Analysis- Structural Comparisons- 2D gel, Mass spec, Protein and Antibody arrays.

Unit V

Protein Databases: Comparison of Protein Sequences and Database searching-Methods for Protein Structure Prediction-Conserved Patterns in Protein sequences and structures-Comparison of Protein 3D structures-Predicting Functions based on DNA and Protein sequences

LIF C212	Microbial Technology	4	0	0	4	Ms.K.Umamaheswari
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Unit I

Enzyme and cell immobilization: methods of immobilization, electrostatic and external mass transfer effect on immobilization, internal mass transfer effects on immobilization.

Unit II

Microbial growth kinetics: Monod growth kinetics, other forms of growth kinetics, unstructured and structured model of growth kinetics, product formation kinetics, cell destruction kinetics.

Unit III

Bioreactors: batch reactor, feed batch reactor, continuous stirred tank reactor with and without cell recycle, plug flow reactor, enzyme reactors, reactor dynamics and stability, non ideal reactor, residence time distribution, mixing pattern.

Unit IV

Sterilization and transport processes: batch and continuous sterilization, sterilization by filtration, thermal death kinetics, gas-liquid mass transfer in bioreactors, mass balance for two phase bioreactor, mass transfer coefficient and its estimation, power requirement of bioreactors, scaling up, bubble column bioreactor, animal and plant cell bioreactors.

Unit V

Mixed growth kinetics: neutralism, mutualism, commensalism and amensalism, dynamics of two species growth, competition and selection, Lotka-Volterra model, other prey and predator models, population dynamics.

LIF E205	Tissue Engineering	3	0	0	3	Guest Faculty
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Unit I

Tissue engineering in perspective: The basis of growth and differentiation - Morphogenesis and tissue engineering - In vitro control of tissue development - Growth factors - Tissue engineering bioreactors - Tissue assembly in microgravity

Unit II

Synthesis of Tissue and organs: *In vitro* synthesis of Tissue and organs - Organotypic and histiotypic models of engineered tissues - Biomaterials in tissue engineering - Approaches to transplanting engineered cells and tissues - Engineering challenges in immunisolation device development.

Unit III

Fetal tissue engineering - Breast reconstruction - Small-diameter vascular grafts - Cardiac prostheses - Bioartificial pancreas - Hepatassit liver support system - Heamatopoietic system: Red Blood cell substitutes.

Unit IV

Renal replacement devices - Musculoskeletal system: Structural tissue engineering - Bone regeneration through cellular engineering - Brain implants - Neural stem cells.

Unit V

Periodontal applications - Regeneration of dentin - Skin: Wound repair: Basic biology to tissue engineering - Artificial Womb.

LIF C213	Plant Biotechnology	4	0	0	4	Guest Faculty
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Unit I

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

Unit II

Symbiotic nitrogen fixation in legumes by *Rhizobia* - Nitrogen fixation in Cyanophyta, the biochemistry, molecular biology and gene rearrangement - *Agrobacterium* and crown gall tumors - Mechanism of T-DNA transfer to plants, Ti plasmid vectors and its utility - Classification and molecular biology of plant viruses - Molecular biology of plant stress response. Transgenic plants and applications-vaccine and other biological developments.

Unit III

Genetic engineering: in plants, selectable markers, reporter genes and promotor used in plants by physical means - Genetic engineering of plants for construction of genome libraries and cDNA libraries, -Molecular breeding-probe construction - recombinant selection and screening - Analysis of expression - Analysis of recombinant DNA, sequencing mutagenesis, altered expression and engineering genes - DNA amplification, key processes, analysis of amplified products and the applications - Cloning hosts.

Unit IV

Inducible control of gene expression: an overview - Use of the *TN10*-encoded tetracycline repressor to control gene expression - Ecdysteroid agonist-inducible control of gene expression in plants - Glucocorticoid-inducible gene expression in plants - Tissue-specific, copper-controllable gene expression in plants - Nitrate inducibility of gene expression using the nitrite reductase gene promoter - Use of heat-shock promoters to control gene expression in plants

Unit V

Wound-inducible genes in plants -Developmental targeting of gene expression by the Use of a Senescence-specific promoter - Abscisic acid-and stress-induced promoter switches in the control of gene expression - Potential use of hormone-responsive elements to control gene expression in plants

LIF C214	Lab course in Bioprocesses and Genetic Engineering	0	0	2	2	Guest Faculty / Prof.P.Ramasamy
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Bioprocessing in the lab using bioreactors (batch and continuous bioprocessing) - Lab fermentation of antibiotics _ Efficient recovery of the products - Gene manipulation to producer microbes for the production of antibiotics in the laboratory experimental bioreactors – use of plasmids, phages, restriction enzymes, gene mapping and use of pulse field electrophoresis in gene mapping

LIF E206	Basic Biotechnology	3	0	0	3	Prof. P.Ramasamy
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Unit I

Biology to Biotechnology: General Introduction Microbial Biotechnology:

Unit II
Fermentation Biotechnology

Unit III
Cell culture and Biotechnology of animals: Food and agriculture – Environment and Energy -

Unit IV
DNA biotechnology: Genetic Engineering – Immunology and health – Cell Biotechnology –

Unit V
Biosafety – Intellectual property protection in Biotechnology – Biotechnology for developing countries.

LIF E207	Basic Molecular Biology	3	0	0	3	Ms. K.Umamaheswari
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Unit I
Introduction to molecular biology
Genetic material: Nucleic acid conveys Genetic information.

Unit II
Structure of DNA, replication, transcription and translation - genetic code.

Unit III
Mutations and repair of DNA, structure and function of RNA, protein synthesis,

Unit IV
Regulation of gene expression

Unit V
Plasmids and transposons - recombinant DNA technology and genetic engineering.

LIF C215	Genetic engineering	4	0	0	4	Prof.P.Ramasamy
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Unit I
Core techniques in gene manipulation: Cloning strategies; Construction of gene libraries; Probe construction.

Unit II
Recombinant technology: Selection and screening- DNA sequencing, RFLP, DNA finger printing.

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

Unit IV
Expression systems and their applications: Production of protein from cloned genes; gene cloning in research, medicine and agriculture.

Unit V
Intellectual Property Rights (IPR) and patents, biosafety, containment facilities for Genetic Engineering experiments, Regulations on field experiments and release of GMO's (Genetically Modified Organisms), labeling of GM (Genetically Modified) Foods.

LIF C216	Lab Course in Genetic engineering	0	0	2	2	Prof.P.Ramasamy
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Cloning of DNA into expression vectors - transformation of microbes - Southern hybridization - Use of radioactive and nonradioactive probes - S1 mapping -DNA sequencing - genome analysis in micro-, phyto-and zoo-Subjects - Site directed mutagenesis and PCR.

LIF E208	Immunotechnology	3	0	0	3	Guest Faculty
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Unit I
Antigen: Isolation, purification and characterisation of various antigens and haptens from pathogens and other biological molecules by biophysical and chemical and affinity separation methods.

Unit II

Production of antibodies: purification of antibodies, Quantitation of immunoglobulin by RID, EID and nephelometry.

Unit III

Hybridoma and monoclonal antibody production: Immunodiagnosis & Applications of monoclonal antibodies in biomedical research; human monoclonal antibodies; Catalytic antibodies; complement fixation test; assessment of immune complexes in tissues.

Unit IV

Purification of mononuclear cells from peripheral blood: Isolation and characterization of T cell subsets; B cells and macrophages; Fluorescent Activated cell sorter (FACS); Mitogen and Antigen induced Lympho-proliferation assay; cell mediated Lympholysis; Mixed Lymphocyte reaction; Assessment of delayed hypersensitivity reactions; Macrophage cultures; Assay for Macrophage activation; Isolation of dendritic cells; In situ & In vivo characterization of cells from tissues; Generation of T cell clones; HLA typing.

Unit V

Biology & assay of cytokines: Vaccine technology including DNA vaccines; Identification of T & B epitopes for vaccine development; immunotechnology and infectious diseases. Immunoscreening of recombinant library.

LIF E209	Gene technology	2	1	0	3	Prof.P.Ramasamy
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Unit I

The concept of genes: molecular anatomy of eukaryotic genes-control of gene expression-recombinant DNA technology-polymerase chain reaction-fundamental principles of cloning-vectors for use in plant and animal cells.

Unit II

Principal genomic and cDNA cloning strategies: genetically modified micro-organisms-plant, animals-molecular techniques in prenatal diagnosis-cystic fibrosis, muscular dystrophies, huntington's disease-coronary heart disease, microbial infections-Recombinant DNA methods in vaccine development-molecular diagnosis of cancer – gene therapy-protein engineering.

Unit III

Genetic engineering and rDNA technology: genetic complexity-enzymes used in gene manipulation of DNA, RNA-restriction endonucleases-molecular scalpels-isolation and purification of DNA –plasmids-isolation and purification of plasmid DNA-isolation of MRNA from mammalian cells-Autoradiography-electrophoresis of DNA-pulsed field gel electrophoresis (PFGE)-Nucleic Acid staining-Nucleid Acid labeling-molecular probes-hybridization techniques-DNA fingerprinting – (DNA profiling)-Restriction fragment length polymorphism (RFLP)-Blotting Techniques-vectors-Gene cloning-Screening and analysis of Recombinants-protoplast Technology-fusion techniques – DNA-protein interactions-DNA libraries.

Unit IV

Chromosome: walking and chromosome jumping-site directed mutagenesis-DNA synthesis-techniques of gene mapping-tibozyme-polymerase chain reaction (PCR)-Random amplification of polymorphic DNA (RAPD)-subtraction hybridization-ribotyping-protein engineering-strain improvement-gene transfer technologies (DNA transfer methods)-transgenesis-Gene targeting-Antisense therapy-flow cytogenetics-human genome project

Unit V

Ethical, legal, social, environmental and health issues related to gene biotechnology

LIF C217	Lab Course in Plant Biotechnology	0	0	2	2	Guest Faculty
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On hand training in cell and tissue culture and maintenance of culture lines - Callus propagation of plants - Protoplast manipulation - agrobacterium technology - Electroporation - Biolistic transformation - Southern and Northern hybridization.

LIF E210	Basic Enzyme Technology	3	0	0	3	Dr. G.Vijaiyan Siva
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Unit I

Properties of Enzymes: **Catalytic Power – Specificity – Regulation – Cofactors**

Unit II

Nomenclature and Classification of Enzymes

Unit III

Purification of Enzymes: Strategy – Source – Subcellular localization – Methods of homogenization – Methods of separation

Unit IV

Industrial Enzymes: Enzymes used in brewing and cheese making – Enzymes used in production of Organic chemicals – Isolation of Enzymes for Industrial processes – Sources of isolated enzymes – Immobilized enzymes

Unit V

Clinical Aspects of Enzymology: Enzymes as Indicators of disease status – Enzymes as remedial measures for various diseases

LIF C218	Marine Biotechnology	4	0	0	4	Dr.Shyamala
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Unit I

Marine Biology and ecology-Modern concepts in Oceanography, including chemical, physical, and biological process of the sea, environmental factors influencing marine life, and human impact on ocean resources.

Unit II

Marine Microbiology-Microbial biofilms; Marine polysaccharides-biomedical and biotechnological applications; Molecular pathogenicity of aquacultural pathogens; Biochemistry, gene regulation and molecular biology of marine hyperthermophiles - Bioremediation-Marine pollution; Aerobic and anaerobic bioremediation in the marine environment; Marine microorganisms capable of degrading and detoxifying chlorinated hydrocarbons and other pollutants

Unit III

Gene technology for shellfish and finfishes- Receptor molecules and chemical signals that control life in ocean; Use of transgenic technology to study fish growth and development; Genetic engineering and ploidy manipulation to enhance growth, reproduction and development of disease resistance in aquacultural species crustaceans, molluscan, finfishes and algae, Cryobiology in Marine germplasm preservation.

Unit IV

Biofouling and Control technology- Biofouling organisms; Problems due to biofouling; Antifouling paints and its environmental pollution; Biotechnological approach to biofouling control.

Unit V

Marine natural products-Marine organisms: an alternative source of potentially valuable natural products; Bioactive agents: trends in discovery and application; Production technology for bioactive substances; Pharmaceuticals from marine organisms: anti-cancer, diagnostic and therapeutic, bioadhesives and thermostable enzymes.

LIF E211	Environmental Biotechnology	3	0	0	3	Dr. Vijaiyan Siva
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Unit I

Biofilm Kinetics: Completely mixed biofilm reactor-Soluble microbial products and inert biomass-Special-case biofilm solutions.

Unit II

Reactors: Reactor types-A batch reactor-A continuous-flow stirred-tank reactor with effluent recycle-A plug-flow reactor -A plug-flow reactor with effluent recycles-Reactors with recycle of settled cells-Using alternate rate models-Linking stoichiometric equations to mass balance equations-Engineering design of reactors-Reactors in series.

Unit III

Denitrification: Physiology of denitrifying bacteria-Tertiary denitrification-One-sludge denitrification-Drinking-water treatment:Anaerobic treatment by methanogenesis-Uses for methanogenic treatment-Reactor configurations-Special factors for the design of anaerobic sludge digesters.

Unit IV

Detoxification of Hazardous chemicals: Factors causing molecular recalcitrance-Synthetic organic chemical classes-Energy metabolism versus cometabolism-Electron donor versus electron acceptor-Minimum substrate concentration (S_{min})-Biodegradation of problem environmental contaminants-Bioremediation:Engineering strategies for bioremediation-Evaluating bioremediation.

Unit V

Sewage and waste treatment: pollution monitoring, control and remediation (petroleum industry, paper industry, chemical industry etc)- Biogas- Biomass from the wastes.

LIF E212	Biosensors	3	0	0	3	Guest Faculty
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Unit I

Biological elements – Immobilisation of biological Component.

Unit II

Transducers I – Electrochemistry

Unit III

Transducers II - Optical METHODS

Unit IV

Transducers III – Other Transducers – Performance Factors .

Unit V

Important Applications – Experimental Examples – Commercial Applications.

LIF C219	Dissertation and Viva-Voce	C	0	0	3+2	5	All Faculty
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M.Sc. APPLIED PLANT SCIENCE

Subject Code	Title of the Course	C/E /Ss	Credits				Course Faculty
			L	T	P	C	
SEMESTER – I							
LIF C301	Growth Differentiation and Morphogenesis	C	3	-	1	4	R.Rengasamy J. Muthumary
LIF C302	Biodiversity – I. Lower Plants	C	3	-	1	4	N. Anand V. Kaviyarasan
LIF C303	Biodiversity – II. Higher Plants	C	3	-	1	4	P. Ebenezer K. Periasamy
	Elective 1 - Parent Department	E	3	-	-	3	
	Elective 2 – Other Departments	E	3	-	-	3	
LIF S301	Self-study1	SS	3	-	-	3	
SEMESTER – II							
LIF C304	Microbiology	C	3	-	1	4	S.S.Gnanamanickam N. Mathivanan
LIF C305	Plant Cell Biology	C	3	-	1	4	N. Raman K. Periasamy
LIF C306	Molecular Genetics	C	3	-	1	4	V. Kannan V. Kaviyarasan
	Elective 3 - Parent Department	E	3	-	-	3	
	Elective 4 – Other Departments	E	3	-	-	3	
LIF S302	Self-study 2	SS	3	-	-	3	
SEMESTER – III							
LIF C307	Plant Ecology	C	3	-	1	4	K. Murugesan P. Ebenezer
LIF C308	Plant Molecular Biology and Biotechnology	C	3	-	1	4	R. Balasubramanian
LIF C309	Plant Functions	C	3	-	1	4	V.Kannan
	Elective 5 - Parent Department	E	3	-	-	3	
	Elective 6 – Other Departments	E	3	-	-	3	
LIF S303	Self-study 3	SS	3	-	-	3	
SEMESTER – IV							
LIF C310	Molecular Plant Pathology	C	3	-	1	4	R. Balasubramanian P.T.Kalaichelvan
LIF C311	Algal Biotechnology	C	3	-	1	4	N. Anand R.Rengasamy
LIF C312	Fungal Biotechnology	C	3	-	1	4	J. Muthumary N. Raman

LIF C313	Dissertation and Viva-Voce	C	0	-	6	6	
LIF S304	Self-study 4	SS	3	-	-	3	
Electives offered for Parent Department / for Other Departments							
SEMESTER – I & III							
LIF E301	Bioinformatics	E	3	-	-	3	P.T.Kalaichelvan
LIF E302	Agrotechniques for medicinal plants	E	3	-	-	3	K. Murugesan
LIF E303	Biopesticides	E	3	-	-	3	N. Mathivanan
LIF E304	Tissue culture	E	3	-	-	3	N. Raman
LIF E305	Bioproducts from algae	E	3	-	-	3	R. Rengasamy
LIF E306	Phytohaemagglutinins	E	3	-	-	3	R. Balasubramanian
LIF E307	Nitrogen cycle	E	3	-	-	3	N. Mohan
LIF E308	Bioremediation	E	3	-	-	3	V.Kannan
LIF E309	Beneficial microbes	E	3	-	-	3	K. Periasamy
SEMESTER – II & IV							
LIF E310	Electron microscopy	E	3	-	-	3	J. Muthumary
LIF E311	Limnology	E	3	-	-	3	N. Anand
LIF E312	Control of Plant Diseases	E	3	-	-	3	K. Murugesan
LIF E313	Mass Cultivation of Algae	E	3	-	-	3	R. Rengasamy
LIF E314	Phytopharmacognosy	E	3	-	-	3	P.T.Kalaichelvan
LIF E315	Mushroom Cultivation	E	3	-	-	3	V. Kaviyarasan
LIF E316	Mycorrhizal Biotechnology	E	3	-	-	3	N. Raman
LIF C301	Growth Differentiation and Morphogenesis	C	3	-	1	4	R.Rengasamy J. Muthumary

Concepts of growth - increase in size, increase of substances, in cell number, growth as order out of disorder. Differentiation - development – morphogenesis - Relative growth rate - measurement of growth - fresh weight, cell number, dry weight, length, surface area, chlorophyll, protein, DNA. Localization of growth - cell division and vacuolation - growth cell wall - Levels of differentiation - autonomous units - canalization of development - Cells and tissue differentiation - patterns of differentiation - cell differentiation and environmental factors - induction of similar patterns - Embryo development - shoot apical meristem - different types of apices - development of lateral branch - initiation and development of leaves - leaf determination - flower initiation and development - fruit development - root apical meristem - different types of apices - Polarity axial polarity, dorso-ventral polarity, radial polarity - structural basis of polarity - cytoskeleton - factors affecting polarity in lower plants - illumination electric current, pH, temperature - polar growth of cells, polar wall formation orientation of polar growth by environmental factors - light, gravity. Cell cycle - G₀, G₁, S and G₂ phases - timing of G₁ and S phases - synthesis and accumulation of RNA and protein - abbreviated cell cycle - coenocytes, polyploidy, diplochromosomes, polyteny - Totipotency - morphogenetic propensity - tissue culture - selection of suitable medium - callus induction - organogenesis - cell culture - tissue culture of monocots - protoplast culture - somatic hybridization - meristem culture - germ plasm techniques - application of plant tissue culture. Role of the plant growth regulators - Auxin, Gibberellin, Cytokinin, Abscisic acid, Ethylene and other compounds - Hormone concept - importance of growth hormones in plant functions - regulatory role of plant hormones - Photoperiodism - flowering response to photoperiodic treatment - general principles of photoperiodism - photoperiod during plants life cycle - phytochrome and the role of dark period - the Florigen concept - flowering hormones and inhibitors - Morphogenetic factors and environment - effects of light, temperature, physical factors, mechanical factors - Biological rhythm - definition of circadian and other rhythms - rhythm characteristics - light, temperature, applied chemicals - Phytochrome - discovery of phytochrome - physical and chemical properties of phytochrome - distribution of phytochrome among species, tissues and cells - phytochrome and germination of seeds - flowering - Vernalization - location of the low-temperature response in plants - devernalization - vernalin - Dormancy - concepts and terminology - seed longevity and germination - seed dormancy - bud dormancy - Plant movements - nastic movements and tropism - nyctinasty, thigmonasty - phototropism, gravitropism and other tropisms.

LIF C302	Biodiversity – I. Lower Plants	C	3	-	1	4	N. Anand V. Kaviyarasan
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General account of cryptogamic plants - ICBN - important principles and rules - rule of priority - type concept - Binomials - citation. - General account on the structures and reproduction of algae belonging to

Chlorophyceae, Xanthophyceae, Crysophyceae, Phaeophyceae, Rhodophyceae, Dinophyceae, Cryptophyceae, Eustigmatophyceae, Bacillariophyceae, and Cyanophyceae. Reasons for calling cyanophyceae as cyanobacteria. Diversity and distribution among algae. Morphological and structural diversity - flagellar diversity - pyrenoid diversity - chloroplast diversity - General account on the structure and reproduction of fungi belonging to myxomycetes, coelomycetes, hyphomycetes, phycomycetes, ascomycetes, basidiomycetes. Importance of Mycorrhizal association, culturing and cultivation of mushrooms. Lichens and their structure and reproduction - Broad classification of Bryophytes, comparison of gametophytes and sporophytes of hepatica and musci - development of sporophytes. Bryophytes as fore runner of land plants – phylogeny - Economic importance of algae and fungi - nitrogen fixers - pollution indicators. Uses of macro algae (seaweeds) - Edible and poisonous mushroom. Economic importance of fungal diseases

LIF C303	Biodiversity – II. Higher Plants	C	3	-	1	4	P. Ebenezer K. Periasamy
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PTERIDOPHYTES:

A.comparative study of distribution, morphology, anatomy and reproduction of the various groups of Pteridophytes. eg. Psilophytopsida, Psilotopsida Lycopsida, Sphenopsida, Pteropsida.

GYMNOSPERMS:

A comparative study of distribution, morphology, anatomy and reproduction of the various groups of Gymnosperms.eg.Cycadopsida, Coniferopsida, Gnetopsida. - Phylogeny and Palaeontology of the various groups of Pteridophytes and Gymnosperms.

ANGIOSPERMS:

History of Taxonomy of Angiosperms, Contributions of the ancient and modern taxonomists and their system of classifications. Recent trends of Chemotaxonomy and Numerical taxonomy - Systematic classifications of Linnaeus, Bentham & Hooker, Engler & Prantle and Hutchinson. Merits and demerits of their system of classifications. International Code of Botanical Nomenclature (ICBN). Rules and regulations, Binomial Nomenclature and typification - Methodology of using keys for identification of higher plants. Preparation and preservation techniques for herbaria. Systematic studies and phylogenetic relationship among the mono and dicot plants. Economic importance of medicinal and aromatic plants.

Practical:

Study of morphology, anatomy and reproductive structures of the representative forms of the Pteridophytes and Gymnosperms and to study taxonomic grouping of the following families of Angiosperms.

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|--------------------|--------------------|----------------------|---------------------|
| 1. Magnoliaceae | 2. Menispermaceae | 3. Brassicaceae | 4. Polygalaceae |
| 5. Caryophyllaceae | 6. Tiliaceae | 7. Oleaceae | 8. Portulacaceae |
| 9. Rhamnaceae | 10. Sapindaceae | 11. Moringaceae | 12. Droseraceae |
| 13. Onagraceae | 14. Passifloraceae | 15. Cactaceae | 16. Rubiaceae |
| 17. Sphenocleaceae | 18. Plumbaginaceae | 19. Salvadoraceae | 20. Bignoniaceae |
| 21. Pedaliaceae | 22. Nyctaginaceae | 23. Aristalochiaceae | 24. Piperaceae |
| 25. Loranthaceae | 26. Urticaceae | 27. Casuarinaceae | 28. Amaryllidiaceae |
| 29. Typhaceae | 30. Commelinaceae | 31. Araceae | 32. Palmaceae |
| 33. Poaceae | 34. Cyperaceae | | |

LIF C304	Microbiology	C	3	-	1	4	S.S.Gnanamanickam N. Mathivanan
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Introduction to Microbiology - The scope of microbiology - evolution of the science - Characterization of microorganisms - microscopic observations - Classification of microorganisms - Kingdom: Procaryotae: Archaeobacteria and major classes of Eubacteria including Rickettsias, Chlamydiae and Actinomycetes. Characteristics of Bacteria - Morphology and fine structure-cell wall, membrane and internal structures - cultivation methods - reproduction and bacterial growth - Genetics of Microorganisms - Modifications and mutations-Transformation, Transduction and Conjugation - Methods of replication - Introduction to Phage Genetics. Other Microorganisms - Fungi -The molds and yeasts, Algae, Protozoa and Viruses - Basic classification of each group of micro-organisms. Microbial Products and Applied Microbiology: Antibiotics,

Enzymes, Vitamins-Microorganisms involved in Human diseases and Plant Diseases - Genetic manipulation/biotechnology of microbes - Manipulation of microorganism for products such as wine, cheese, insulin etc. Engineering biological control agents: Bacillus, Pseudomonas - Isolation of different microorganisms: fungi, bacteria, viruses, bacteriophages - biochemical profiles of bacteria-microbial assays in Laboratory-plant assays for viruses on Nicotiana glutinosa-Assays for microbial products: antibiotics, enzymes, vitamins etc - Others.

LIF C305	Plant Cell Biology	C	3	-	1	4	N. Raman K. Periasamy
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Electron microscopes and their use in the cell biology – Transmission electron microscope, Scanning Electron microscope – Shadow casting – Freeze etching – Autoradiography - Cell theory – Cell as a unit of life – Differences between Prokaryotic and Eukaryotic cells – Features of plant cell and bacteria under electron microscope - Organization of plant cell wall and plasma membrane - Composition of cytoplasm – Structure of vacuoles - Ultrastructure and functional aspects of mitochondria and chloroplast – Development and evolution of mitochondria and chloroplast Ultrastructure and function of Endoplasmic reticulum, Ribosomes, Spherosomes, Lysosomes, Microbodies, Golgi complex - Microtubules and microfilaments - Nuclear organization – Morphology – Structure of nuclear envelope, nucleus, nucleolus, chromosomes and nucleic acids (DNA and RNA) - Mechanism and control of cell division in prokaryotes and eukaryotes, phycoplast and phragmoplast – Closed and open mitosis – Variations in mitotic division, meiosis – Types and phases of meiosis – Cell cycle and cell differentiation.

LIF C306	Molecular Genetics	C	3	-	1	4	V. Kannan V. Kaviyarasan
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Chromosomes and heredity - Linkage and recombination-crossing over - mitotic recombination Molecular organization of chromosomes in viruses, bacteria, and eukaryotic organisms - Repetitive sequences, transposable elements- Nature of Genetic Material-Nucleic Acids: structure and function of DNA, RNA - semiconservative replication of DNA - replication of circular DNA - modes of replication - Fidelity of replication - proof reading - DNA repair - Microbial Genetics - methods of DNA uptake - transformation-transduction and conjugation in Bacteria - Phage Genetics - Phage mutants - gene recombination in phages - genetic mapping in Phage - T4 fine structure mapping of T4 rII locus - Gene Expression - Transcription -Messenger RNA - Translation - The Genetic Code - Ribosomes, transfer RNA - Mechanisms of Protein synthesis - Regulation of Gene Expression - The Operon model - Transposable elements: terminology and transposition. Mutations - Genes in Population - Hardy Weinberg Law.

Practicals:

Isolation of DNA, RNA-PCR-Tn mutagenesis and use of mutants-transformation of bacteria with Marker genes.

LIF C307	Plant Ecology	C	3	-	1	4	K. Murugesan P. Ebenezer
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Introduction: History, general concepts, scope, relevance to modern society - The ecosystem: Components of the ecosystem, individual population and community, climatic, edaphic and biotic factors - Functions of the ecosystem: Energy flow through different trophic levels, primary and secondary productivity, food chain and food web, Biogeochemical cycles - C, N, S, P. - Evolution of an ecosystem: Succession - hydrosere and xerosere, climax concept, homeostasis, dispersal, barriers, endemism - The terrestrial ecosystem: Major biomass of the world, interaction of different factors, degradation of ecosystem - The aquatic ecosystem: Marine and fresh water ecosystems, special factors of aquatic ecosystem, productivity and food chains, problems of pollution - Ecology in the Indian context: Botanical regions and forest types of India; conservation and management of soil, water and forests.

LIF C308	Plant Molecular Biology and Biotechnology	C	3	-	1	4	R. Balasubramanian
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Plant genome organization - structural features of a representative plant gene - gene family in plants - Organization of chloroplast genome - nucleus encoded and chloroplast encoded genes for chloroplast proteins - targeting of proteins to chloroplast - Organization of mitochondrial genome - nuclear and mitochondria - encoded genes for mitochondrial proteins - RNA editing in plant mitochondria - mitochondrial genome and cytoplasmic male sterility - Molecular aspects of seed development - role of ABA in seed maturation - events in seed germination - Transposable elements in maize, organization and function. - Plant hormones - biosynthesis of IAA, C₂H₂, ABA, GA - (molecular basis of action) receptors - signal transduction - structure of phytochrome - possible functions - Early events in symbiotic nitrogen fixation in legumes by *Rhizobia* - nod factors - nodulins in nodule development - Molecular biology of crown galls - *Agrobacterium tumefaciens* - mechanism of T-DNA synthesis - transfer to plants - Ti- Plasmid vectors for plant transformation. Structure and replication of RNA and DNA viruses - novel strategies for control.- Molecular biology of thermotolerance in plants - anoxia - oxidative stress - Genetic engineering in plants - selectable markers, reporter genes - promoters used in plant vectors. Direct gene transfer - electroporation - biolistic gun. Genetic engineering of plants for viruses, bacteria, fungi resistance, pest resistance, herbicide resistance - molecular biology of plant - microbe pathogen interactions.

LIF C309	Plant Functions	C	3	-	1	4	V.Kannan
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Mineral nutrition - Minerals in plants - the essential elements - macro micro nutrients - functions and principles - nutrient deficiency - symptoms of deficiency and functions of elements - absorption of mineral salts - the roots as absorbing surfaces - principles of solute absorption - passive and active transport theories - the energetic - proton pump for iron transport - essentialate of water - water as solvent - cohesion, adhesion, translocation of water - diffusion, osmosis and chemical potential - the concept of water potential - turgor pressure - diffusion pressure deficit - plasmolysis - Enzymes - biocatalysts - distribution of enzymes in cells - compartmentalization of enzymes - specificity and nomenclature - chemical structure and composition - prosthetic groups, co-enzymes and vitamins - isozymes - mechanisms of enzyme action - Michaelis menton constant [K_m] - inhibitors - competitive and non-competitive inhibitors - enzyme control - feedback and allosteric enzymes. - Nitrogen metabolism - essentiality of nitrogen - nitrogenous compound - nitrogen turn over [nitrogen cycle] - putrefaction, nitrification, denitrification, nitrogen fixation - symbiotic and free living nitrogen fixers - nodule development [*Rhizobium* legume symbiosis] - nif-gene cluster - nitrogenase activity - ammonia assimilation - principle pathways - port of entry of ammonia into various carbon compounds [C₁ to C₅] - nitrate uptake - nitrate reductase - nitrite reductase - structure, composition and functions - genetics of nitrate uptake - Biosynthetic pathways of various amino acids - precursors of amino acids and degradation of amino acids - Protein synthesis - messenger RNA - structure and function of tRNA - structure and function of ribosomes - initiation, elongation, termination of protein synthesis - post translational modifications of proteins - targetics of proteins - ubiquitin ATP mediated protein degradation - Synthesis of purines and pyrimidines - structure of nucleic acids - replication of DNA and repair mechanisms - Respiration and fermentation - cellular respiration - respiration quotient [RQ] - breakdown of starch and sucrose - glycolytic pathway - substrate level phosphorylation - oxidative pentose phosphate pathway - oxitative respiration - citric acid cycle - oxidation of NADH and FADH₂ - proton gradients - synthesis of ATP - ATP synthase - alternative electron pathways - external NADPH dehydrogenases - rotenone insensitive NADH dehydrogenase - gluconeogenesis - Photosynthesis - light energy - light harvesting pigments - primary and accessory pigments - specific absorption of pigments - reaction centres - water split by photosystem II - electron transport - proton potential conservation - photosystem I - reduction of NADP - cyclic electron transport - non-cyclic electron transport - ATP synthesis - carbon-fixation using reductase - photorespiration - advantages of C₄ plants over C₃ plants - Krantz anatomy - crassulacean acid metabolism (CAM) - sysnthesis of starch and cellulose - Metabolic products - primary and secondary metabolites - formation of terpenoids - glycosides - phenolics - flabonoids - alkaloids.

LIF C310	Molecular Plant Pathology	C	3	-	1	4	R. Balasubramanian P.T.Kalaichelvan
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Socio economics of plant pathology in sustained agriculture- History of Molecular plant pathology - Major diseases of cultivated crops and horticultural crops - epidemics - genetic basis of epidemics - computer simulation - Host-pathogen interactions-Disease detection - Molecular Genetics of Plant Pathogen-Plant Disease management

- for sustained agriculture-(Biotechnology and plant protection) - **Practicals:** Field visits to collect diseased plants-Examination and identification of diseases-Assay of biochemical responses of plants to pathogen infection-Modern techniques in diagnosis and control of diseases-Strain improvement of biocontrol agents-Biotechnology in disease resistance.

LIF C311	Algal Biotechnology	C	3	-	1	4	N. Anand R.Rengasamy
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General account of algae of economic importance-micro and macro algae, occurrence and distribution - importance of preparative stages in cultivation. - Micro algae used as biofertilizers - nitrogen fixing forms - free living and symbiotic nitrogen fixers - *Azolla* biotechnology - mass cultivation of BGA in field - importance and choice of carrier material - immobilization technique - Mass culturing of micro algae like *Spirulina*, *Dunaliella*, *Haematococcus* and *Botryococcus*. Use as single cell protein - some of bioactive compounds and bio products - upstream and downstream process of mass production. Industrially important enzyme from algae - Mass cultivation of macro algae - rope cultivation, culturing in the laboratory - use of seaweeds in environmental biotechnology - SLF and its potential - Genetics of algae - nif genes, strain improvement - transformation, protoplast fusion technology for macro algae.

LIF C312	Fungal Biotechnology	C	3	-	1	4	J. Muthumary N. Raman
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Fermentation technology - basics of fermentation process - surface culture process, submerged culture process - batch mode - continuous mode - by products of ethanol fermentation - ethanol from sugar substrates - microbiology of ethanol production - Protoplast isolation - protoplast fusion technology - protoplast as tools for genetic manipulation - protoplast as experimental systems in physiology and biochemistry - Fungal enzymes - source of fungal enzymes - commercially important fungal enzymes - culture conditions and enzyme production - economics of enzyme production Industrial uses of fungal enzymes - Citric acid production - fermentation procedure - product recovery - stages of fermentation process - uses of citric acid - submerged culture using yeast - Fungal antibiotics - other secondary metabolites - vitamins - fungi as food - mushroom cultivation - fungal biofertilizers - fungi as biocontrol agents - mycobactericides -

Practicals:

Isolation of industrially important fungi - identification - fungal protoplast fusion technique - mushroom cultivation - citric acid and alcohol production - mycorrhizal inoculum production -

LIF E301	Bioinformatics	E	3	-	-	3	P.T.Kalaichelvan
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Introduction to information theory of Biology - Net working - websites and server - Data base in Biology computation in statistical analysis remote sensings - imaging - Computational methods for molecular Biology - Computational algorithms - Supporting genomic research DNA sequence comparison and assembly for hybridization mapping - Phylogenetic reconstruction, genome rearrangement. Introduction protein folding and threading software C++ XML

LIF E302	Agrotechniques for medicinal plants	E	3	-	-	3	K. Murugesan
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History of ayurveda - unani and siddha medicine - Medicinal and aromatic plants - taxonomy - importance in identification and breeding pure lines - Biodiversity - endangered medicinal plants - importance of biodiversity conservation - protection and cultivation - Developing agro techniques for cultivation of important medicinal plants agro techniques - cultural practices Vs. active principle (irrigation, fertilizers, weeding, season and soil type) - Physiology of the cultivated plants Vs. active principle. (age, biomass, leaf weight and tillering) - Commercial value (economically feasible or cost effective) women entrepreneurship development - marketing cultivated medicinal plants - mass cultivation.

LIF E303	Biopesticides	E	3	-	-	3	N. Mathivanan
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Introduction and importance of biopesticides. Types of biopesticides: Bioinsecticides - biofungicides - biobactericides - bionematicides - bioherbicides - Important bioinsecticides: Bt, NPV, - fungal bioinsecticides (Beauveria, Metarhizium, Verticillium, Paecilomyces, Nomuraea). Mass production - formulation - application for the control of insect pests - Important biofungicides: Trichoderma, Gliocladium, Pseudomonas fluorescens, mass production - formulation - use in agriculture for the control of crop diseases - Biobactericide: Agrobacterium radiobacter. Use in control of crown gall disease. Bionematicides: Verticillium - Trichoderma. Control of root knot nematodes. Bioherbicides: Phytophthora - Colletotricum - Advantage for the use of biopesticides - Problems in commercialization and efficacy - commercial products of biopesticides.

LIF E304	Tissue culture	E	3	-	-	3	N. Raman
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Benefits of plant tissue culture – Cell and organ differentiation – Clonal propagation or micropropagation - Artificial seeds, virus free seeds – Somaclonal variation – Overcoming cross barriers – Other uses of tissue culture such as endosperm and nucellus cultures, germplasm storage including cryopreservation – Application of cell culture for mutant selection, production of secondary metabolites, transformations - Tissue culture technology in India - Laboratory equipment for plant tissue culture – general needs, dish-washing procedure, Plant tissue culture laboratory working procedures - Aseptic techniques and use of antibiotics - Environmental factors for growth and development - Tissue culture media and their constituents – MS, B₅ and White's media – cell culture including Bergmann's plating technique - Types of plant tissue culture – embryo culture, meristem culture, callus culture, anther culture, protoplast culture, cell suspension, fern spore culture - Protoplast culture, regeneration and somatic hybridization – isolation of protoplasts, purification of protoplasts, viability of protoplasts, protoplast culture and regeneration of plants, protoplast fusion and somatic hybridization, cytoplasmic hybrids or cybrids, genetic modification of protoplasts - Gene transfer methods in plants – target cell for transformation, vectors for gene transfer, gene transfer techniques for Agrobacterium, selectable and scoreable markers, agroinfection and gene transfer, physical delivery methods or DNA mediated gene transfer (PEG stimulated, microinjection, macroinjection, microprojectile or particle gun, electroporation) - Transgenic plants – transgenic plants for crop improvement, transgenic plants for molecular farming, transgenic to study regulated gene expression.

LIF E305	Bioproducts from algae	E	3	-	-	3	R. Rengasamy
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Extraction of polysaccharides – agar, carragenan and alginate - Determination of gel strength, gelling temperature, melting temperature, viscosity. Properties and uses of phycocolloids. Extraction of iodine and its uses - Formation for single cell protein - Spirulina, Chlorella - Extraction of β -carotene from Dunaliella – formulation – Extraction of Astaxanthin from Haematococcus – formulation. Extraction and formulation of glycerol from Botryococcus. Properties and uses of SCP, β -carotene, astaxanthin and glycerol.

LIF E306	Phytohaemagglutinins	E	3	-	-	3	R. Balasubramanian
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Definition - structure - types - distribution in plants - general properties - their role in seed development - fate of lectins in seed germination - Role of lectins in plant microbe interactions - role of lectins in fungus -fungus interactions.

LIF E307	Nitrogen cycle	E	3	-	-	3	N. Mohan
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Reduction of nitrate - assimilation of nitrate - Assimilation of ammonia - nitrogen assimilation and carbohydrate utilization - Nitrogen fixation - nitrogen cycle - nitrification - denitrification - ammonification - free living and symbiotic nitrogen fixation - Leguminous plants - stem nodules - nitrogen fixation.

LIF E308	Bioremediation	E	3	-	-	3	V.Kannan
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Bioremediation definition, concept - rationale - kinds of pollution - organic, inorganic in soil, water and air - remediation by bacteria, fungi and green plants - Processes of bioaccumulation and biomagnification - microbial

remediation by natural attenuation - biostimulation - bioaugmentation - application of immobilized microbes in soil decontamination - use of genetically engineered microorganism and bioremediation - Biodegradation of organic compounds - humification and polymerization reaction - bio-transformation of metal and metal compounds - phyto-remediation use of green plants to remove pollutants - Phyto-extraction - induced phyto-extraction and continuous phyto-extraction - phyto-degradation - rhizofiltration - phyto-stabilisation - phyto-volatilisation of metals - phyto-remediation of organic - bioavailability and uptake - biotransformation and compartmentalisation.

LIF E309	Beneficial microbes	E	3	-	-	3	K. Periasamy
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Introduction to industrially important microorganisms: Bacteria, fungi, actinomycetes and micro algae. Culture techniques: Isolation, Identification, Maintenance - Role of microorganisms in various industries - Food: Yeast, mushroom, microalgae and food spoilage organisms Pharmaceuticals: Production of antibiotics, vaccines, hormones, diagnostic proteins, vitamins, steroids, enzymes and amino acids - role of transformed microorganisms in pharmaceuticals - Agriculture: Biofertilizer, biocontrol of microbial pathogens, biopesticides, plant growth promoters, secondary metabolites - Industrial enzymes: Important enzymes - application in food leather, textile, paper, detergent, pharmaceutical industries - role of transformed microorganisms in enzyme production - Environment: Bioremediation of recalcitrant synthetic chemical products, pesticides, fungicides and preservatives, waste recycling, industrial effluent treatment - Dairy: Importance of microbe in dairy and dairy products production of ethanol, amino acids, organic acids, by conventional and recombinant organisms - methanogens and methylotrops - advantages and disadvantages.

LIF E310	Electron microscopy	E	3	-	-	3	J. Muthumary
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Introduction to Electron Microscopy: Electron Microscope laboratory - equipment - precautionary measures to be taken in the lab - Physical principles of Electron Microscopy: Resolution - Magnification - Transmission Electron Microscopy (TEM):

- a) TEM - major components: microscopic column, illumination system - imaging system - image translating system
- b) Specimen Preparation for TEM: Fixation - aims, primary fixation, dehydration, infiltration, embedding, polymerization, block making. Ultramicrotomy - Glass knife making, sectioning and staining sections. Photography in electron microscope.

Scanning Electron Microscope (SEM):

Preparation of tissue for SEM: Preparation of reagents, selection of specimen for SEM, fixation, washing, dehydration, critical point drying, specimen mounting, sputter coating, photography in SEM - Routine maintenance of EM Lab - Cryotechniques for electron microscopy -Cryofixation: Plunge freezing, slam freezing, spray freezing, propane - jet freezing. Immuno Gold labeling techniques - Immuno Gold Staining (IGS): Colloidal Gold marker, Resins, LR White LR Gold - lowicryls, polymerization, labeling procedures.

LIF E311	Limnology	E	3	-	-	3	N. Anand
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Lakes - their distribution, origins, forms - distribution of fresh waters - Tectonic basins - lakes formed by volcanic activity - lakes formed by landslides - lakes formed by glacial activity - solution lakes - lake basins formed by river activity - wind formed lake basins - basins formed by shore line activity - lakes of organic origin - Light in lakes - Light as an entity - electromagnetic spectrum - absorption of light - light scattering - Aquatic ecosystems - Structure and productivity - lake ecosystem concept - lacustrine zonation and terminology - Dead organic matter - population growth and regulation - Oxygen - solubility of oxygen in fresh water - distribution of dissolved oxygen - orthograde oxygen profile -clinograde oxygen profile - Salinity of inland waters - Ionic composition of surface waters - weathering of soil and rock - environmental influences on salinity - Inorganic carbon - nitrogen cycle - phosphorus cycle - iron, sulphur and silica cycles - Planktonic communities - Algae - Morphological and physiological characteristics - pigments - blue green algae - green algae - yellow green algae - golden brown algae - diatoms - Cryptomonads - Dinoflagellates - Euglenoids - Brown and Red algae.

LIF E312	Control of Plant Diseases	E	3	-	-	3	K. Murugesan
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Introductory Plant Pathology - classification of plant diseases - foliar and root diseases - Principles of plant protection - importance of plant disease control - Chemical control of plant diseases - important fungicides and bactericides - classification - mode of action - development of resistance in pathogens - Biological control - Important biocontrol agents - mechanisms of biological control - problems and prospects of biological control in field conditions - Induction of resistance in plants - PR proteins. Integrated disease management - biotechnology in plant disease management.

LIF E313	Mass Cultivation of Algae	E	3	-	-	3	R. Rengasamy
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Microalgae: *Spirulina*, *Chlorella*, *Dunaliella*, *Haematococcus* - Morphology and life history - High value products - SCP, phycocyanin, β -carotene, astaxanthin - importance - cultivation - media composition - scale up - lab to land - raceway ponds, photoreactor, fermenter - Marine macroalgae: *Hypnea*, *Gracilaria*, *Gelidiella*, *Kappaphycus*, *Porphyra*, *Laminaria*, *Enteromorpha*, *Ulva* - Morphology and life history - Polysaccharides - agar, carrageen, alginate - economic importance - seaweed as food, feed, SLF - role of seaweeds in aquaculture - antibiotics from seaweeds - cultivation - Tides and waves - continental slope and shelf - lagoons, archipelagos, coral bed - types of cultivation fixed, lift, semifloating, floating - substrata - coir, nylon ropes, dead corals, cement blocks - Lab to sea - *Porphyra*, 'conchocelis' vegetative, reproductive phases - conditions germ lings - cultivation in sea - *Laminaria*, gametophytes, zygotes, germlings, cultivation in sea - *Gracilaria*, carpospores - germ lings, field cultivation - *Enteromorpha*, *Ulva* - swarmers, germ lings - field cultivation - vegetative propagation of *Gracilaria*, *Gelidiella*, *Hypnea*, *Kappaphycus*.

LIF E314	Phytopharmacognosy	E	3	-	-	3	P.T.Kalaichelvan
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General introduction - the chemical classification of drugs. Structure, properties, characteristics and mode of action of carbohydrate and related compounds - glycosides - tannins - lipids - vegetable oil - resins and resin combinations - alkaloids - lignin compound - Vitamins and vitamin containing drugs - enzymes and enzyme containing drugs - proteins and related drugs - antibiotics - Illegens and allergenic preparation - poisonous plants - biopesticides - biocides - biofungicides

LIF E315	Mushroom Cultivation	E	3	-	-	3	V. Kaviyaran
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Introduction to Mushroom Cultivation - Edible and Mushroom (Historical account, most commonly cultivated mushroom in the world, distribution and production in various countries) - Button Mushroom - Morphology, commercial production (Morphology of button mushroom, occurrence, distribution, commercial production in developing and developed countries, and farm design) - Raising of pure culture and spawn preparation (Tissue culture method, spore culture method, preparation of spawn substrate, inoculation and incubation storage and transportation of spawn, quality spawn and contaminants) - Preparation of compost & cultivation of *A. bisporus* and *A. bitorquis* preparation (Definition of compost, materials used during compost - base materials and supplements animal manures, nitrogen, carbohydrate rich materials and material to rectify mineral deficiencies, different compost formulations, method of compost preparation - long method, short method, qualities of a good compost; advantages of bulk pasteurization; spawning methods after care casing - definition, use of casing, formulae of casing soil, treatment of casing soil - chemical pasteurization method process of casing, agronomic practices followed during casing, spawned casing, ruffling, supplement with casing soil, after care, harvesting - the time of harvest, size of mushrooms, method of picking and importance of proper harvesting methods to improve the shelf life) - Factors effecting button mushroom production (Temp, pH, air and water management, competitor moulds and other disease). Packing preservation and marketing (Grading packing - unit packing and bulk packaging systems preservation - controlled environment and canning, marketing and terminology) - Oyster Mushroom and Milky Mushroom - Morphology and commercial production of oyster mushrooms. (Morphology, occurrence, distribution, commercial production in developing and developed countries and farm design) - Preparation of pure culture and spawn (Tissue culture and spore culture methods, spawn substrate preparation, inoculation, incubation spawn storage and identification of contaminated spawn) - Cultivation methods (Substrate selection, sterilization - chemical, hot water, fermentation / composting, steam pasteurization substrate supplements, bed preparation, casing for *Calocybe indica*, cropping room and maintenance) - Harvesting, processing, preservation and marketing (Method of picking, grading preservation - controlled environment, dehydration, freezing, freeze-drying, steeping preservation and canning, packing - unit and bulk packaging and factors) - Factors influencing mushroom production (pH, light, temp, water management, abiotic disorders and biotic disorders - competitor moulds and other factors) - Paddy Straw and Other Mushrooms - Cultivation of paddy straw mushroom (Morphology, distribution, raising of pure culture, spawn production, spawn production, spawning, cultivation methods, harvesting, preservation, marketing) - Cultivation of *Lentinus*

edodes, Auricularia sp. and Calocybe indica (Lentinus – cultivation on wood logs – preparation of log, spawn preparation, spawning and crop management; cultivation on synthetic logs – substrate preparation; bag filling, sterilization, spawning, crop management and harvesting; Auricularia – log cultivation and bag culture, spawn preparation, spawning, crop management, Calocybe indica – spawn preparation substrate preparation, spawning, harvesting, crop management).

Pest and Disease, Economics - Pests and diseases of edible mushrooms (Environmental, fungal, bacterial, viral, insect pests and nematode disease and competitor moulds) - Economics of mushroom cultivation (Fixed assets, recurring expenditure, labour, economics of cultivation throughout the year and seasonal growing formulation of project report for getting finance from funding agencies) - Precautions in mushroom cultivation (Precautions to be taken while selecting the area, spawn preparation, spawning, spawn run, during cropping, harvesting etc) - Mushroom recipes (Western and Indian recipes, pickles, powders, jams, etc.)

LIF E316	Mycorrhizal Biotechnology	E	3	-	-	3	N. Raman
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Mycorrhizae - functions and importance. Taxonomy and morphology of mycorrhizae. Types of mycorrhizae - Ectomycorrhizae - Isolation, maintenance and pure culture, mass culture. Endomycorrhizae - Isolation, identification, mass multiplication and inoculation to host plants. Ericaceous endomycorrhizae - Orchidaceous endomycorrhizae – Ectendomycorrhizae - Nutrient mobilization and metabolic exchange of mycorrhizae - Nutrient mobilization, Soil mineralization, Soil organic matter - Nutrient cycling and metabolic exchange - Potential for management of VAM in agriculture and Horticulture - Application of VAM inoculum on transplanted crops. Phosphorus, Nitrogen, Carbon cycling and Water uptake. VAM and plant pathogens interactions. Influence of agricultural practices and agrochemical on VAM - VAM and plant breeding - Ectomycorrhizae as biocontrol agent - Antibiotic production in mycorrhizal association, fungal mantle, chemical inhibitors produced by host - Mechanism of suppression of pathogen by VAM fungi - Potential for management of ectomycorrhizae in forestry - Afforestation practices, reclamation of waste lands and reforestation practices - Mycorrhizae and bioremediation - Phytoremediation - Types of phytoremediation - Role of ectomycorrhizae in heavy metal bindings. Role of AM fungi in heavy metal tolerance - Genetics and genetic manipulation of mycorrhizal fungi - Isolation of genomic DNA from VAM spores - Genetic investigations of ectomycorrhizal fungi.

M.Sc. INDUSTRIAL MICROBIOLOGY

Subject Code	Title of the Course	C/E /Ss	Credits				Course Faculty
			L	T	P	C	
SEMESTER – I							
LIF C401	Microbial Diversity	C	3	-	1	4	Prof. N. Anand Dr. V. Kannan
LIF C402	Industrially Important Microorganisms	C	3	-	1	4	Dr. V.Kaviyaran Dr. N.Mathivanan
LIF C403	Microbial Cell Biology	C	3	-	1	4	Prof. N. Raman Dr. K. Periasamy
	Elective 1 – Parent Department	E	3	-	-	3	
	Elective 2 – Other Departments	E	3	-	-	3	
LIF S401	Self-study 1	SS	3	-	-	3	
SEMESTER – II							
LIF C404	Growth of Microorganisms	C	3	-	1	4	Prof. J. Muthumary Dr. P. Ebenezer
LIF C405	Microbial Physiology and Biochemistry	C	3	-	1	4	Prof. K.Murugesan Dr. N.Mohan
LIF C406	Enzyme Technology	C	3	-	1	4	Prof. R. Balasubramanian
	Elective 3 – Parent Department	E	3	-	-	3	
	Elective 4 – Other Departments	E	3	-	-	3	
LIF S402	Self-study 2	SS	3	-	-	3	
SEMESTER – III							
LIF C407	Microbial Genetics and Molecular Techniques	C	3	-	1	4	Prof. S.S.Gnanamanickam Dr. N. Mathivanan
LIF C408	Microbial Biotechnology- I Gene Technology	C	3	-	1	4	Prof. P.T.Kalaichelvan Dr. N.Mohan

LIF C409	Microbial Biotechnology-II Bioprocess, Social and Economic Implications	C	3	-	1	4	Prof. N. Anand Prof. R. Rengasamy
	Elective 5 – Parent Department	E	3	-	-	3	
	Elective 6 – Other Departments	E	3	-	-	3	
LIF S403	Self-study 3	SS	3	-	-	3	
SEMESTER – IV							
LIF C410	Semester long Field (Industrial) work	C	0	-	12	12	
LIF C411	Dissertation and Viva-Voce	C	0	-	6	6	
LIF S404	Self-study 4	SS	3	-	-	3	

Electives offered for Parent Department / for Other Departments							
SEMESTER – I & III							
LIF E401	Bioinformatics	E	3	-	-	3	Prof. P.T.Kalaichelvan
LIF E402	Agrotechniques for medicinal plants	E	3	-	-	3	Prof. K. Murugesan
LIF E403	Biopesticides	E	3	-	-	3	Dr. N. Mathivanan
LIF E404	Tissue culture	E	3	-	-	3	Prof. N. Raman
LIF E405	Bioproducts from algae	E	3	-	-	3	Prof. R. Rengasamy
LIF E406	Phytohaemagglutinins	E	3	-	-	3	Prof. R. Balasubramanian
LIF E407	Nitrogen cycle	E	3	-	-	3	Dr. N. Mohan
LIF E408	Bioremediation	E	3	-	-	3	Dr. V.Kannan
LIF E409	Beneficial microbes	E	3	-	-	3	Dr. K. Periasamy
SEMESTER – II & IV							
LIF E410	Electron microscopy	E	3	-	-	3	Prof. J. Muthumary
LIF E411	Limnology	E	3	-	-	3	Prof. N. Anand
LIF E412	Control of Plant Diseases	E	3	-	-	3	Prof. K. Murugesan
LIF E413	Mass Cultivation of Algae	E	3	-	-	3	Prof. R. Rengasamy
LIF E414	Phytopharmacognosy	E	3	-	-	3	Prof. P.T.Kalaichelvan
LIF E415	Mushroom Cultivation	E	3	-	-	3	Dr. V. Kaviyaran
LIF E416	Mycorrhizal Biotechnology	E	3	-	-	3	Prof. N. Raman

MASTERS COURSES ABSTRACT

LIF C401	Microbial Diversity	C	3	-	1	4	Prof. N. Anand Dr. V. Kannan
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Microbes - definition - concept and rationale - cell as a basic unit - cell organization - Prokaryotic - Eukaryotic and Archaeic - Bacteria - shape, size Organization - ultrastructure of bacterial cell - Habitat - Normal and specialized habitats - presence in water, soil, air, on plants, animals - inside the plants, (endophytes) - inside the organs of higher animals and human - presence in extreme environments - at high temperature, high acidity, high alkalinity - high salinity at very low temperature and on glaciers - Taxonomic groups of bacteria - classical and phylogenetical classification - numerical taxonomy taxonomic groups as in Bergey's manual of systematic groups bacteriology - taxonomic diversity of useful bacteria - classification of Archaea - classification of actinomycetes - Viruses - structure and function - classification of viruses - replication of viruses - bacteriophages, plant viruses and animal viruses - Fungi - Introduction, systemic position, substrates colonized by fungi. Fungal thallus - Morphology, septation, cell structure, specialized somatic structure - Reproduction in fungi - Asexual, sexual and parasexual cycle. Fungal nutrition - classification with brief introduction of difference groups of fungi - Life cycles of fungi - Algae - structure - ultra structure and life histories of microalgae belonging to various algal classes - classical and modern concepts of classification - Ecology of fresh water and marine microalgae - terrestrial and symbiotic forms - role of microalgae in human welfare.

LIF C402	Industrially Important Microorganisms	C	3	-	1	4	Dr. V.Kaviyaran Dr. N.Mathivanan
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Introduction to industrially important microorganisms: Bacteria, fungi, actinomycetes and micro algae - Culture techniques: Isolation, Identification, Maintenance - Fermentation technology: Types of fermentation -

solid-state fermentation. Important parameters for fermentation - optimization of production - Down stream process: Isolation and purification of enzymes - antibiotics and other microbial compounds - Role of microorganisms in various industries - Food: Yeast, mushroom, microalgae and food spoilage organisms - Pharmaceuticals: Production of antibiotics, vaccines, hormones, diagnostic proteins, vitamins, steroids, enzymes and amino acids - role of transformed microorganisms in pharmaceuticals - Agriculture: Biofertilizer, biocontrol of microbial pathogens, biopesticides, plant growth promotors, secondary metabolites - Industrial enzymes: Important enzymes - application in food leather, textile, paper, detergent, pharmaceutical industries - role of transformed microorganisms in enzyme production - Environment: Bioremediation of recalcitrant synthetic chemical products, pesticides, fungicides and preservatives, waste recycling, industrial effluent treatment - Dairy: Importance of microbe in dairy and dairy products. production of ethanol, amino acids, organic acids, by conventional and recombinant organisms - methanogens and methylotrops - advantages and disadvantages.

Practicals:

Isolation and identification of microbes (bacteria, fungi, algae) - Production of organic acids - acetic acid, citric acid, ethanol, amino acids Production of microbial enzymes - amylase, cellulase, protease, laccase and lipases - Test for biocontrol agents - Trichoderma with plant pathogens.

LIF C403	Microbial Cell Biology	C	3	-	1	4	Prof. N. Raman Dr. K. Periasamy
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Electron microscopes and their use in the cell biology - Transmission electron microscope, Scanning Electron microscope - Shadow casting - Freeze etching - Autoradiography - Cell theory - Cell as a unit of life - Differences between prokaryotic and Eukaryotic cells - Features of plant cell and bacteria under electron microscope - Mycoplasma - Actinomycetes - Structure and organization of bacterial cell - Bacterial cell wall - Gram positive cell wall - Gram negative cell wall - Peptidoglycan structure - Components external to cell wall - Capsules - Slime layers, S-layers - Pili and Fimbriae - Ultrastructure and growth of flagella - Motility - Chemotaxis - Chemoreceptors - Organisation and functions of bacterial plasma membrane - Mesosomes - Composition of cytoplasm - Ribosomes and other inclusions of cytoplasm - Nucleoid - Structure and organization - Nucleic acids - DNA, RNA - Bacterial endospore - Structure and development - Cyanobacteria - Ultrastructure and organization - Thylakoids - Phycobilosomes - Ultrastructure and organization of fungal cell - Yeast and filamentous fungi - Cell wall structure and organelles in different groups of fungi - Mitochondria, Endoplasmic reticulum, Golgi bodies - Lomasomes - Lysosomes - Microbodies - Woronin bodies - Protoplast.

LIF C404	Growth of Microorganisms	C	3	-	1	4	Prof. J. Muthumary Dr. P. Ebenezer
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Growth of bacteria: Binary fission - synthesis of new cell wall components generation time, cell numbers - Growth of yeast and unicellular organisms: Budding, Fission, Pseudo branching - Growth of filamentous fungi: Hyphal extension, radical extension, linear extension, hyphal tip, hyphal branching, intertwining of hyphal strands, hyphal fragmentation, pellet formation, biomass - Growth of algae: Cell numbers, cell mass, concentration of pigments - Measurement of microbial growth - direct microscopic counts, viable plate counts, cell number, automated cell counting, dry cell weight, packed cell volume, turbidity, coulter counter, flow cytometer, stoichiometry, product formation, viscosity - Image analysis: Growth assessment by image analysis - Growth in response to environment - the effect of various environmental factors - temperature, water activity, pH, carbon source, nitrogen source, chemical nutrient concentration, radiation effects, atmospheric pressure, Hydrostatic pressure, thermophiles, psyderophiles, acidophiles, alkaliphiles - Design of Growth Media: Elemental requirements, specific nutrient requirements, energy requirements, environmental needs, Techno-economic constraints - Culture Techniques: Pure culture methods, axenic cultures, solid cultures, liquid cultures. Preparation of inocula, maintenance of stock cultures, sub-culture, culture preservation methods, control of microbial growth - Specialized culture techniques: Large scale cultures, Batch cultures, Fed-batch cultures, continuous cultures turbidostat and chemostat.

LIF C405	Microbial Physiology and Biochemistry	C	3	-	1	4	Prof. K. Murugesan Dr. N. Mohan
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Microbial metabolism - ATP the universal currency - principles of energy metabolism- Thermodynamic principles- Energy coupling -Enzyme catalysis - enzyme specificity- features of active sites- competitive and non-competitive inhibition- classification of enzymes- prosthetic groups, co-factors- regulation of enzyme synthesis- action of lysozyme - Mmbrane transport - features of biological membranes - ultrastructure of plasma membrane- fluid-mosaic model-mechanism and energetics of solute transport- active transport - Metabolic pathways- aliphatic and aromatic hydrocarbons- glycolysis and glyconeogenesis- Nitrogen and sulphur metabolism- nitrogen cycle-biosynthesis of amino acids- oxaloacetate and pyruvate pathways- PEP and RUBP

pathways - Protein synthesis- synthesis of biopolymers- DNA - RNA polymerization - DNA repair- DNA replication.

LIF C406	Enzyme Technology	C	3	-	1	4	Prof. R. Balasubramanian
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Enzyme nomenclature - classification of industrially important enzymes - applications in industry - proteases - xylanases - pectinolytic enzymes - cellulolytic and chitinolytic enzymes - Molecular aspects - purification of extra and intracellular enzymes - estimation of purity. Immobilization of enzymes - methods of enzyme immobilization - adsorption - entrapment - direct co-valent linkage - cross linkage Bioreactors - packed bed reactor - mixed bed reactor - applications - Biosensors - basic principles - bioelectrodes - optodes - immunochemical biosensors - Enzyme electro catalysis - immobilization of enzymes - electrodes - measurement of enzyme activity - regeneration of cofactors.

LIF C407	Microbial Genetics and Molecular Techniques	C	3	-	1	4	Prof. S.S.Gnanamanickam Dr. N. Mathivanan
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Introduction: Genetic terminology - mutations - methods of genetic analysis of mutants - genetic recombination-genetic mapping - complementation and complementation analysis - Nucleic acids: DNA, RNA and their characteristics - DNA Replication - The Geometry - Enzymology - Methods of Replication - DNA damage and Repair - Polypeptide chains. - Gene Expression in Different Microorganisms - Transcription-Messenger RNA-Translation-The Genetic Code - Ribosomes and Polypeptide synthesis - Regulation of Gene Expression - The Operon model - Transposable elements: terminology and transposition - Life Cycle of Bacteriophage - Phage Genetics - Phage mutants-gene recombination in phages-genetic mapping in Phage T4-fine structure mapping of T4 rII locus-Life Cycle of Phages-Immunity and repression-Transducing particles and Transducing phage. - Genetic Engineering: Joining of DNA molecules-Vectors-Restriction enzymes-Cloning restriction fragments in a Plasmid- c-DNA and the use of Reverse transcriptase- Cloning of single stranded DNA- Gene Libraries - Applications of Genetic Engineering Restriction mapping-site specific mutagenesis-production of proteins from cloned genes-shuttle vectors-Transgenic plants, animals and other organisms and their uses.

UnitVII: Isolation of DNA- genomic DNA, Plasmid DNA - quantification of DNA - plasmid curing with acridine orange, mitomycin, Ethidium bromide, Methyl orange - Restriction digestion of DNA - ligation of vector and host DNA - transformations- preparation of competent cells of E.coli DH5 alpha using CaCl₂ followed by transformation- blue/white selection- alpha complementation.- Using X-Gal, agarose gel Electrophoresis- Electroelution of DNA Bnds, southern hybridization - western blot, extraction proteins-estimation - Native PAGE - SDS -PAGE - Immobilization Denitometric scanning of gels - mutation studies, UV-EMS-Somatic hybridization.- Isolation of protoplasts - viability testing, fusion, electroporation, particle bombardment with biolystic gun - isolation of bacteriophage.

Practicals:

Isolation of DNA, RNA - Tn mutagenesis and use of mutants - transformation of bacteria with Marker genes -PCR - Demonstration of plant transformation protocols-Others designed by the Instructor.

LIF C408	Microbial Biotechnology- I Gene Technology	C	3	-	1	4	Prof. P.T.Kalaichelvan Dr. N.Mohan
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Restriction endonucleases as a biological tool for DNA fragments generation linkers and adaptors - Vectors - nature - uses of vectors - Type of vectors - Bacteriophage vectors - cosmid vectors - shuttle vectors - Expression of cloned genes in *E. Coli* - promoter efficiency - stability of mRNA - translation initiation - cloning host for the over production of protein. DNA sequence analysis - double stranded - deoxychain terminator method of Sanger - The Polymerase chain reaction - mechanism - advantages, Application of gene technology in different fields - Production of pharmaceuticals from recombinant cells - insect control - improved biological detergents - bacterial genomes

LIF C409	Microbial Biotechnology-II Bioprocess, Social and Economic Implications	C	3	-	2	5	Prof. N. Anand Prof. R. Rengasamy
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Exploitation of Microorganisms: Design and operation of a fermentor - Variation in fermentor design - solid state fermentation - culture system - batch culture - fed batch culture - semi continuous culture - continuous culture - Strategies for maximizing productivity and output. Yeast metabolites - production of amino acids, SCP, Downstream processing (product recovery) - Economical and social implications in developing countries- Biotechnology - changes in international trade and future economic systems - Bio-business - marketing of technology - commercial biotechnology in south- east Asia - wastes - global perspective - scientific and technological uncertainties - relative competitiveness - timing of introduction and rate of diffusion - routinization of the basic technique - threshold barriers and shifting manufacturing frontiers - company strategy - national policies - trade reversals - privatization of scientific knowledge - International policy issues - role of transnational corporations - privatization of biotechnology - Intellectual property rights - public / private sector issues - physical property and intellectual property - farmers rights - trade secrets - plant breeders rights - Patents - patenting biological materials - obligation with patent applications - patenting of life forms - seed production and farmers right - international conventions - patents for higher plant and higher animals - patenting transgenic organisms and isolated genes - patenting of genes and DNA sequences - implications of patenting of biotechnological discoveries - sharing the benefits from biotechnology - technology transfer - Ethical concerns about patenting of living organisms and genetic material - release of recombinant microorganisms - field trials - Bt cotton - intrinsic value in nature - sustainability and environmentalism - need for new bio ethics - naturally occurring and recombinant microorganisms in the environment - threat of gene escape via hybridization - biomedical products - risk regulations - guidelines and regulation for the release of genetically engineered microorganisms.

LIFE 401	Bioinformatics	E	3	-	-	3	Prof. P.T.Kalaichelvan
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Introduction to information theory of Biology - Net working - websites and server - Data base in Biology computation in statistical analysis remote sensings – imaging - Computational methods for molecular Biology - Computational algorithms - Supporting genomic research DNA sequence comparison and assembly for hybridization mapping. - Phylogenetic reconstruction, genome rearrangement. Introduction protein folding and threading software C++ XML

LIF E402	Agrotechniques for medicinal plants	E	3	-	-	3	Prof. K. Murugesan
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History of ayurveda - unani and siddha medicine.- Medicinal and aromatic plants - taxonomy - importance in identification and breeding pure lines - Biodiversity - endangered medicinal plants - importance of biodiversity conservation - protection and cultivation - Developing agro techniques for cultivation of important medicinal plants agro techniques - cultural practices Vs. active principle (irrigation, fertilizers, weeding, season and soil type). - Physiology of the cultivated plants Vs. active principle. (age, biomass, leaf weight and tillering) - Commercial value (economically feasible or cost effective) women entrepreneurship development - marketing cultivated medicinal plants - mass cultivation.

LIF E403	Biopesticides	E	3	-	-	3	Dr. N. Mathivanan
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Introduction and importance of biopesticides. Types of biopesticides: Bioinsecticides - biofungicides - biobactericides - bionematicides –bioherbicides - Important bioinsecticides: Bt, NPV, - fungal bioinsecticides (Beauveria, Metarhizium, Verticillium, Paecilomyces, Nomuraea). Mass production - formulation - application for the control of insect pests - Important biofungicides: Trichoderma, Gliocladium, Pseudomonas fluorescens, mass production - formulation - use in agriculture for the control of crop diseases. - Biobactericide: Agrobacterium radiobacter. Use in control of crown gall disease. Bionematicides: Verticillium - Trichoderma. Control of root knot nematodes. Bioherbicides: Phytophthora – Colletotricum - Advantage for the use of biopesticides - Problems in commercialization and efficacy - commercial products of biopesticides.

LIF E404	Tissue culture	E	3	-	-	3	Prof. N. Raman
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Benefits of plant tissue culture – Cell and organ differentiation – Clonal propagation or micropropagation - Artificial seeds, virus free seeds – Somaclonal variation – Overcoming cross barriers – Other uses of tissue culture such as endosperm and nucellus cultures, germplasm storage including cryopreservation – Application of cell culture for mutant selection, production of secondary metabolites, transformations - Tissue culture technology in India - Laboratory equipment for plant tissue culture – general needs, dish-washing procedure, Plant tissue culture laboratory working procedures - Aseptic techniques and use of antibiotics - Environmental factors for growth and development.- Tissue culture media and their constituents – MS, B₅ and White’s media – cell culture including Bergmann’s plating technique - Types of plant tissue culture – embryo culture, meristem culture, callus culture, anther culture, protoplast culture, cell suspension, fern spore culture - Protoplast culture, regeneration and somatic hybridization – isolation of protoplasts, purification of protoplasts, viability of protoplasts, protoplast culture and regeneration of plants, protoplast fusion and somatic hybridization, cytoplasmic hybrids or cybrids, genetic modification of protoplasts - Gene transfer methods in plants – target cell for transformation, vectors for gene transfer, gene transfer techniques for *Agrobacterium*, selectable and scoreable markers, agroinfection and gene transfer, physical delivery methods or DNA mediated gene transfer (PEG stimulated, microinjection, macroinjection, microprojectile or particle gun, electroporation) - Transgenic plants – transgenic plants for crop improvement, transgenic plants for molecular farming, transgenic to study regulated gene expression.

LIF E405	Bioproducts from algae	E	3	-	-	3	Prof. R. Rengasamy
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Extraction of polysaccharides – agar, carragenan and alginate - Determination of gel strength, gelling temperature, melting temperature, viscosity - Properties and uses of phycocolloids. Extraction of iodine and its uses - Formation for single cell protein - Spirulina, Chlorella - Extraction of β -carotene from *Dunaliella* – formulation – Extraction of Astaxanthin from *Haematococcus* – formulation. Extraction and formulation of glycerol from *Botryococcus*. Properties and uses of SCP, β -carotene, astaxanthin and glycerol.

LIF E406	Phytohaemagglutinins	E	3	-	-	3	Prof.R. Balasubramanian
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Definition - structure - types - distribution in plants - general properties - their role in seed development - fate of lectins in seed germination - Role of lectins in plant microbe interactions - role of lectins in fungus -fungus interactions.

LIF 1013	Nitrogen cycle	E	3	-	-	3	Dr. N. Mohan
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Reduction of nitrate - assimilation of nitrate - Assimilation of ammonia - nitrogen assimilation and carbohydrate utilization - Nitrogen fixation - nitrogen cycle - nitrification - denitrification - ammonification - free living and symbiotic nitrogen fixation - Leguminous plants - stem nodules - nitrogen fixation.

LIF E408	Bioremediation	E	3	-	-	3	Dr. V. Kannan
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Bioremediation definition, concept - rationale - kinds of pollution - organic, inorganic in soil, water and air - remediation by bacteria, fungi and green plants - Processes of bioaccumulation and biomagnification - microbial remediation by natural attenuation - biostimulation - bioaugmentation - application of immobilized microbes in soil decontamination - use of genetically engineered microorganism and bioremediation - Biodegradation of organic compounds - humification and polymerization reaction - bio-transformation of metal and metal compounds - phyto-remediation use of green plants to remove pollutants - Phyto-extraction - induced phyto-extraction and continuous phyto-extraction - phyto-degradation - rhizofiltration - phyto-stabilisation - phyto-volatilisation of metals - phyto-remediation of organic - bioavailability and uptake - biotransformation and compartmentalisation.

LIF E409	Beneficial microbes	E	3	-	-	3	Dr. K. Periasamy
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Introduction to industrially important microorganisms: Bacteria, fungi, actinomycetes and micro algae. Culture techniques: Isolation, Identification, Maintenance - Role of microorganisms in various industries - Food: Yeast, mushroom, microalgae and food spoilage organisms - Pharmaceuticals: Production of antibiotics, vaccines, hormones, diagnostic proteins, vitamins, steroids, enzymes and amino acids - role of transformed microorganisms in pharmaceuticals - Agriculture: Biofertilizer, biocontrol of microbial pathogens, biopesticides, plant growth promoters, secondary metabolites - Industrial enzymes: Important enzymes - application in food leather, textile, paper, detergent, pharmaceutical industries - role of transformed microorganisms in enzyme production - Environment: Bioremediation of recalcitrant synthetic chemical products, pesticides, fungicides and preservatives, waste recycling, industrial effluent treatment - Dairy: Importance of microbe in dairy and dairy products production of ethanol, amino acids, organic acids, by conventional and recombinant organisms - methanogens and methylotrops - advantages and disadvantages.

LIF E410	Electron microscopy	E	3	-	-	3	Prof. J. Muthumary
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Introduction to Electron Microscopy: Electron Microscope laboratory - equipment - precautionary measures to be taken in the lab - Physical principles of Electron Microscopy: Resolution – Magnification - Transmission Electron Microscopy (TEM):

- c) TEM - major components: microscopic column, illumination system - imaging system - image translating system
- d) Specimen Preparation for TEM: Fixation - aims, primary fixation, dehydration, infiltration, embedding, polymerization, block making. Ultramicrotomy - Glass knife making, sectioning and staining sections. Photography in electron microscope.

Scanning Electron Microscope (SEM):

Preparation of tissue for SEM: Preparation of reagents, selection of specimen for SEM, fixation, washing, dehydration, critical point drying, specimen mounting, sputter coating, photography in SEM - Routine maintenance of EM Lab - Cryotechniques for electron microscopy - Cryofixation: Plunge freezing, slam freezing, spray freezing, propane - jet freezing - Immuno Gold labeling techniques - Immuno Gold Staining (IGS): Colloidal Gold marker, Resins, LR White LR Gold - lowicryls, polymerization, labeling procedures.

LIF E411	Limnology	E	3	-	-	3	Prof. N. Anand
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Lakes - their distribution, origins, forms - distribution of fresh waters - Tectonic basins - lakes formed by volcanic activity - lakes formed by landslides - lakes formed by glacial activity - solution lakes - lake basins formed by river activity - wind formed lake basins - basins formed by shore line activity - lakes of organic origin - Light in lakes - Light as an entity - electromagnetic spectrum - absorption of light - light scattering Aquatic ecosystems - Structure and productivity - lake ecosystem concept - lacustrine zonation and terminology - Dead organic matter - population growth and regulation - Oxygen - solubility of oxygen in fresh water - distribution of dissolved oxygen - orthograde oxygen profile -clinograde oxygen profile - Salinity of inland waters - Ionic composition of surface waters - weathering of soil and rock - environmental influences on salinity - Inorganic carbon - nitrogen cycle - phosphorus cycle - iron, sulphur and silica cycles - Planktonic communities - Algae - Morphological and physiological characteristics - pigments - blue green algae - green algae - yellow green algae - golden brown algae - diatoms - Cryptomonads - Dinoflagellates - Euglenoids - Brown and Red algae.

LIF E412	Control of Plant Diseases	E	3	-	-	3	Prof. K. Murugesan
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Introductory Plant Pathology - classification of plant diseases - foliar and root diseases - Principles of plant protection - importance of plant disease control - Chemical control of plant diseases - important fungicides and bactericides - classification - mode of action - development of resistance in pathogens - Biological control - Important biocontrol agents - mechanisms of biological control - problems and prospects of biological control in field conditions - Induction of resistance in plants - PR proteins. Integrated disease management - biotechnology in plant disease management.

LIF E413	Mass Cultivation of Algae	E	3	-	-	3	Prof. R. Rengasamy
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Microalgae: *Spirulina*, *Chlorella*, *Dunaliella*, *Haematococcus* - Morphology and life history - High value products - SCP, phycocyanin, β -carotene, astaxanthin - importance - cultivation - media composition - scale up - lab to land - raceway ponds, photoreactor, fermenter - Marine macroalgae: *Hypnea*, *Gracilaria*, *Gelidiella*, *Kappaphycus*, *Porphyra*, *Laminaria*, *Enteromorpha*, *Ulva* - Morphology and life history - Polysaccharides - agar, carrageen, alginate - economic importance - seaweed as food, feed, SLF - role of seaweeds in aquaculture - antibiotics from seaweeds - cultivation. - Tides and waves - continental slope and shelf - lagoons, archipelagos, coral bed - types of cultivation fixed, lift, semifloating, floating - substrata - coir, nylon ropes, dead corals, cement blocks - Lab to sea - Porphyra, 'conchocelis' vegetative, reproductive phases - conditions germ lings - cultivation in sea - Laminaria, gametophytes, zygotes, germlings, cultivation in sea - Gracilaria, carpospores - germ lings, field cultivation - Enteromorpha, Ulva - swarmers, germ lings - field cultivation - vegetative propagation of Gracilaria, Gelidiella, Hypnea, Kappaphycus.

LIF E414	Phytopharmacognosy	E	3	-	-	3	Prof. P.T.Kalaichelvan
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General introduction - the chemical classification of drugs. Structure, properties, characteristics and mode of action of carbohydrate and related compounds - glycosides - tannins - lipids - vegetable oil - resins and resin combinations - alkaloids - lignin compounds - Vitamins and vitamin containing drugs - enzymes and enzyme containing drugs - proteins and related drugs - antibiotics - Allergens and allergenic preparation - poisonous plants - biopesticides - biocides - biofungicides

LIF E415	Mushroom Cultivation	E	3	-	-	3	Dr. V. Kaviyaranan
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Introduction to Mushroom Cultivation - Edible and Mushroom (Historical account, most commonly cultivated mushroom in the world, distribution and production in various countries) - Button Mushroom - Morphology, commercial production (Morphology of button mushroom, occurrence, distribution, commercial production in developing and developed countries, and farm design) - Raising of pure culture and spawn preparation (Tissue culture method, spore culture method, preparation of spawn substrate, inoculation and incubation storage and transportation of spawn, quality spawn and contaminants) - Preparation of compost & cultivation of *A. bisporus* and *A. bitorquis* preparation (Definition of compost, materials used during compost - base materials and supplements animal manures, nitrogen, carbohydrate rich materials and material to rectify mineral deficiencies, different compost formulations, method of compost preparation - long method, short method, qualities of a good compost; advantages of bulk pasteurization; spawning methods after care casing - definition, use of casing, formulae of casing soil, treatment of casing soil - chemical pasteurization method process of casing, agronomic practices followed during casing, spawned casing, ruffling, supplement with casing soil, after care, harvesting - the time of harvest, size of mushrooms, method of picking and importance of proper harvesting methods to improve the shelf life) - Factors effecting button mushroom production (Temp, pH, air and water management, competitor moulds and other disease) - Packing preservation and marketing (Grading packing - unit packing and bulk packaging systems preservation - controlled environment and canning, marketing and terminology) - Oyster Mushroom and Milky Mushroom - Morphology and commercial production of oyster mushrooms. (Morphology, occurrence, distribution, commercial production in developing and developed countries and farm design) - Preparation of pure culture and spawn (Tissue culture and spore culture methods, spawn substrate preparation, inoculation, incubation spawn storage and identification of contaminated spawn) - Cultivation methods (Substrate selection, sterilization - chemical, hot water, fermentation / composting, steam pasteurization substrate supplements, bed preparation, casing for *Calocybe indica*, cropping room and maintenance) - Harvesting, processing, preservation and marketing (Method of picking, grading preservation - controlled environment, dehydration, freezing, freeze-drying, steeping preservation and canning, packing - unit and bulk packaging and factors) - Factors influencing mushroom production (pH, light, temp, water management, abiotic disorders and biotic disorders - competitor moulds and other factors) - Paddy Straw and Other Mushrooms - Cultivation of paddy straw mushroom (Morphology, distribution, raising of pure culture, spawn production, spawn production, spawning, cultivation methods, harvesting, preservation, marketing) - Cultivation of *Lentinus edodes*, *Auricularia* sp. and *Calocybe indica* (*Lentinus* - cultivation on wood logs - preparation of log, spawn preparation, spawning and crop management; cultivation on synthetic logs - substrate preparation; bag filling,

sterilization, spawning, crop management and harvesting; Auricularia – log cultivation and bag culture, spawn preparation, spawning, crop management, Calocybe indica – spawn preparation substrate preparation, spawning, harvesting, crop management) - Pest and Disease, Economics - Pests and diseases of edible mushrooms (Environmental, fungal, bacterial, viral, insect pests and nematode disease and competitor moulds) - Economics of mushroom cultivation (Fixed assets, recurring expenditure, labour, economics of cultivation throughout the year and seasonal growing formulation of project report for getting finance from funding agencies) - Precautions in mushroom cultivation (Precautions to be taken while selecting the area, spawn preparation, spawning, spawn run, during cropping, harvesting etc) - Mushroom recipes (Western and Indian recipes, pickles, powders, jams, etc.)

LIF E416	Mycorrhizal Biotechnology	E	3	-	-	3	Prof. N. Raman
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Mycorrhizae - functions and importance. Taxonomy and morphology of mycorrhizae. Types of mycorrhizae - Ectomycorrhizae - Isolation, maintenance and pure culture, mass culture. Endomycorrhizae - Isolation, identification, mass multiplication and inoculation to host plants. Ericaceous endomycorrhizae - Orchidaceous endomycorrhizae – Ectendomycorrhizae - Nutrient mobilization and metabolic exchange of mycorrhizae - Nutrient mobilization, Soil mineralization, Soil organic matter - Nutrient cycling and metabolic exchange - Potential for management of VAM in agriculture and Horticulture - Application of VAM inoculum on transplanted crops. Phosphorus, Nitrogen, Carbon cycling and Water uptake. VAM and plant pathogens interactions. Influence of agricultural practices and agrochemical on VAM - VAM and plant breeding - Ectomycorrhizae as biocontrol agent - Antibiotic production in mycorrhizal association, fungal mantle, chemical inhibitors produced by host - Mechanism of suppression of pathogen by VAM fungi - Potential for management of ectomycorrhizae in forestry - Afforestation practices, reclamation of waste lands and reforestation practices - Mycorrhizae and bioremediation - Phytoremediation - Types of phytoremediation - Role of ectomycorrhizae in heavy metal bindings. Role of AM fungi in heavy metal tolerance - Genetics and genetic manipulation of mycorrhizal fungi - Isolation of genomic DNA from VAM spores - Genetic investigations of ectomycorrhizal fungi.

M. Sc. SPECIAL ZOOLOGY

Subject code	Title of the Course	C/E	Credits			
			L	T	P	C
I Semester						
LIF C501	Biology of Invertebrates	C	2	0	1	3
LIF C502	Biology of Chordates	C	2	0	2	4
LIF C503	Biochemistry	C	3	0	2	5
LIF E501	Concepts in Environmental Impact Assessment	E	3	0	0	3
II Semester						
LIF C504	Cell and Molecular biology	C	3	0	2	5
LIF C505	Evolution	C	2	0	0	2
LIF E502	Basic Immunology	E	2	1	0	3

LIF E503 Radiation Biology	E	3	0	0	3
III Semester					
LIF C506 Environmental Biology	C	3	0	2	5
LIF C507 Environmental Physiology	C	3	0	2	5
LIF C508 Physiology of Integration	C	3	0	2	5
LIF E504 Stem Cell Biology	E	2	1	0	3
LIF E505 Aqua Culture & Fisheries	E	3	0	0	3
LIF C510 Immunology	C	3	0	2	5
LIF C511 Research Methodology	C	4	0	0	4
LIF C512 Dissertation and <i>viva-voce</i>	C	0	1	5	6

MASTERS COURSES ABSTRACT

LIF C501 Biology of Invertebrates	C	2	0	1	3
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Functional morphology - taxonomy - adaptive biology and phylogeny of various invertebrate phyla - Practical: Dissection of the digestive, nervous and reproductive systems of insect, crustacean and mollusc - mounting - mouthparts of *Lepas* sp. and *Balanus* sp. - pedicellariae/Aristotle' lantern and Holothurian spicules.

LIF C502 Biology of Chordates	C	2	0	2	4
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Origin of chordates - biology of protochordates, lampreys, elasmobranchs, lung fishes - adaptive radiation - origin of mammals, human biology of monotremes, marsupials, insectivores, primates, rodents, rabbits, carnivores - Practical : Dissection - 5th, 7th, 9th and 10th cranial nerves in shark/ calotes/ rat -Sympathetic nervous system of frog/calotes/rat Preparation and preservation of skeletal structures of shark/ bony fish/ frog/ toad/ calotes/ snake/ turtle/ crocodile/ pigeon/ sparrow/ mice/ rat Mounting - Weberian ossicles of fish - ear ossicles of rat

LIF C503 Biochemistry	C	3	0	2	5
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Biomolecules and cells - water - proteins - enzymes - sugars - lipids - metabolism - ATP cycle - glycolysis - TCA cycle - Electron transport and phosphorylation - fatty acid oxidation - urea cycle - chemical structures of nucleotides, nucleosides and bases - energy metabolism - Practical: Buffer preparation - pK value determination - aminoacid quantification - TLC separation of aminoacids - Protein precipitation - protein estimation - Enzyme kinetics - Qualitative and quantitative tests for carbohydrates - Extraction of RNA and DNA

LIF E501	Concepts in Environmental Impact Assessment	E	3	0	0	3
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Introduction – Utility of the EIA process – planning and management of impact studies – Predication and assessment of impacts on the Air, Surface water, Soil and Ground water environments – Decision methods for evaluation of alternatives – Expanded scope of EIA –

Requirements : students holding bachelor in zoology, botany and geology with allied zoology are eligible to undergo this elective course.

LIF C504	Cell and Molecular biology	C	3	0	2	5
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Cell theory – prokaryotic and eukaryotic plants – cell membrane – permeability –molecular models – cytoplasm –ultrastructure and functions of cell organelles – chromosomes – nucleolus – cell cycles – mitosis and meiosis - human karyotype, sex chromosomes, sex determination – abnormalities of human chromosomes – genetic map – genetic code – genetic engineering – protein synthesis – nuclear – cytoplasmic interactions – biology and properties of cancer cells – tools to study cell biology - Practical : Cell structure studies – light, phase contract, polarizing and electron microscope – study of subcellular organelles, methods of disrupting cells – isolation of nuclei of rat liver hepatocytes – mitochondria isolation – cell membrane fractionation – Isolation of DNA and RNA –permeability tests – staining Southern blotting – preparation of Chromosome squashes – cell biopsy - normal and cancer cells.– southern blotting – preparation of Chromosome squashes – cell biopsy, normal and cancer cells.

LIF C505	Evolution	C	2	0	0	2
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Theories of evolution - molecular, micro, macro and mega evolution - rates of evolution - adaptation - genetic an non - genetic variations - mutations - ploidy - parthenogenesis - polymorphism - zoogeography - isolation - selection - species concept in biology - species formation - trends and experimental studies in evolution - evolution of man - issues in evolution

LIF E502	Basic Immunology	E	2	1	0	3
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Immunity:Scope and types Organs, Tissues, Cells and Molecules of Immune system. Antigens & Antibodies (structures, types, interactions in vitro & in vivo) Complement system and activation pathways. Mediators of Immune system - **Requirements** : Students holding bachelor degree in zoology, microbiology, biochemistry, biotechnology, botany or any other course with allied zoology are eligible to undergo this elective course.

LIF E503	Radiation Biology	E	3	0	0	3
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1. Natural radiation sources in environment. Background Radiation- High back ground radiation Zones in India and other countries.
2. Basic Physics of Radiation Structure of atom. Properties of nuclei and nuclear particles. Radioactivity, Units of radiation and radioactivity, Laws of radioactive decay, production of isotopes, Interaction of radiation with matter, Radiation detectors and counters.
3. Biological Dose Determination: LET - RBE - Free radical, Survival curves.
4. Radiation Effect at cellular level: Both ionizing and UV: Membranes, organelles and genetic material.Application of nuclear radiation and isotopes in agriculture. Food and pharmaceutical industries, oil health, and salinity management in agriculture.
5. Radiation Repair: DNA repair, genes involved in DNA repair.
6. Radion resistance: M.radiodurance as a model organism.
7. Factor which modulate radiation effects Synergistic, additive and antagonistic effects
8. Radiation and cancer: Epidemiological and clinical examples.
Nuclear disasters and lessons from epidemiological and clinical data.
9. Radiation safety: IAEA regulations - DAE and its role in India - AERB and its guidelines.
10. Social, ethical and economic issues on the use of radioactive materials and nuclear power projects.

Requirements : Students holding bachelor degree in zoology, botany, biochemistry are eligible to undergo this elective course.

LIF C506	Environmental Biology	C	3	0	2	5
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1. Introduction to ecology - Ecological principles - structural concepts - functional concepts - Evolutionary concepts
2. Ecological factors - Physical Chemical - Biotic and Edaphic factors
3. Animal inter-relationships - Adaptations - Biodiversity and Ecosystem functioning -Ecosystem analysis.
4. Ecosystem ecology -Types of ecosystems - Structure - Energy flow - Ecological efficiency - Nutrient cycles -Biogeochemical cycles.
5. Environmental pollution - Eutrophication - types - Pollution and public health - Measurement - control - Management _EIA
6. Resources and Energy - Remote sensing an ecological tool - GIS applications

LIF C507	Environmental Physiology	C	3	0	2	5
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Water and osmoregulation - inorganic ions - nutrition - comparative physiology of digestion and absorption - respiration - intermediary metabolism - nitrogen excretion - respiratory function of blood - temperature - biological rhythms - Practical: Osmoregulation at cellular and organism level - digestion - respiration - excretion

LIF C508	Physiology of Integration	C	3	0	2	5
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Excitable membrane - nervous system - types of neurons - comparative study of vertebrate brains - neurotransmitters, neuromodulators and physiology of synaptic transmission - EEG - epilepsy - sleep learning - memory -muscle: Ultrastructure of skeletal muscle, muscles of vertebrates - contractile proteins - acetyl choline esterase and denervation - ECG and its significance - muscle atrophy - sense organs – bioluminescence - Practical: Effects of transmitters on neurogenic heart of crab and myogenic heart of frog - measurement of arterial blood pressure - recording of heart beat - Chromatophores and colour change - muscle contraction - learning in rats

LIF E504	Stem Cell Biology	E	2	1	0	3
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What are stem cells? Embryonic stem cells, Adult stem cells, the problem of differentiation stem cell location and classification of stem cell niches – germ line, epithelial, epidermal, neuronal niche - Uses of stem cells – Stem cells and cancer treatment, stem cells in tissue engineering, Gene therapy and embryonic stem cells, Therapeutic cloning, Ethical and social consideration of stem cell research **-Requirements** : students holding bachelor degree in zoology, microbiology, biochemistry, biotechnology botany or any other courses with allied zoology and those who are undergoing M.Sc bioinformatics courses are eligible to undergo this elective course.

LIF E505	Aqua Culture & Fisheries	E	3	0	0	3
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World aquaculture - role, status and importance - fishery hydrography - micro nutrients - world fisheries: production, utilization and demand - freshwater, marine, estuarine and brackish water fisheries of India - fishing craft and gear - fish processing and marketing - finfishes - crustaceans - molluscs - sea weed culture - seed production - nutrition: sources, feed formulation - fish diseases and control - field culture - culture technology - Practical: Identification of phyto and zooplankton - identification of fish - gut analysis - identification of sea weeds prawns, crabs, lobsters, edible oysters, pearl oyster, clam etc. - crustacean and molluscan culture: larvae - visit to pearl oyster culture centre, fish farm - fish breeding - hatching techniques - transport of fry.

Requirements: students holding bachelor degree in zoology, or chemistry/botany with allied zoology are eligible to undergo this elective course - Fertilization process – post fertilization changes – cleavage – gastrulation – organiser –organogenesis – extra embryonic membranes and placenta post embryonic development events – ageing - Practical: Development of frog, chick and invertebrates – Experimental embryology.

LIF C510	Immunology	C	3	0	2	5
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Types of immunity - immune organs - immunity in invertebrates and vertebrates - theories of immune responses - antigen - antibody -complement - B & T cells - macrophages - cell - cell co-operation - interleukins and interferons - regulation of immune response - histocompatibility systems and genes - diseases and immune response - immunodeficient diseases - hypersensitivity – allergy - Practical: Preparation of antigens -

immunisation of rats using RBC/bacterial cell wall antigens - sampling of blood for collection of antibodies - antigen - antibody reactions - Demonstration - RIA,ELISA, Separation of T & B lymphocytes, detection of HCG

LIF C511	Research Methodology	C	4	0	0	4
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Biological instrumentation: Microscopy and micrometry - principle and application of centrifuges, colorimetry, spectrophotometer, tracer techniques. Analytical separation methods. Bioinformatics - Practical: Microscopy - Spectrophotometry - pH meter - centrifuge - radioactivity measure - chromatography - electrophoresis.

LIF C512	Dissertation and <i>viva-voce</i>	C	0	1	5	6
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M.Phil. BIOCHEMISTRY

COURSE CODE	TITLE OF THE COURSE	C/E	L	T	P	C	FACULTY
I SEMESTER							
LIF C001	Research Methodology	C	4	1	0	5	All Faculty
LIF C002	Analytical methods	C	4	1	0	5	All Faculty
LIF E001	Induction of Diseases in experimental animal models	E	4	1	0	5	S.Subramanian A.J.Vanisree
LIF E002	Biochemical evaluation of drug efficacy	E	4	1	0	5	A.J.Vanisree & G..Sudhandiran
LIF E003	Molecular diagnostics in the control of diseases	E	4	1	0	5	S.Niranjali Devaraj & G.Sudhandiran
LIF E004	Biochemical Evaluation of Herbal Formulation	E	4	1	0	5	T.Devaki & A.J.Vanisree
II SEMESTER							
LIF C003	Dissertation & Viva Voce	C	-	-	-	21	Supervisor

M.Phil BOTANY

Course Code	Title of the Course	C/E	Credits				Faculty
			L	T	P	C	
First Semester							
LIF C101	Research Methodology	C	4	1	0	5	All Faculty
LIF C102	Applied Research Methodology	C	4	1	0	5	Supervisor
LIF C103	Algology	C	4	1	0	5	N.Anand / R.Rengasamy
LIF C104	Mycology	C	4	1	0	5	J.Muthumary / N.Raman / P. Ebenezer/V. Kaviyaran K. Periasamy
LIF C105	Molecular Plant Pathology	C	4	1	0	5	R.Balasubramanian / S.S.Gnanamanickam P.T.Kalaichelvan / K.Murugesan/V. Kannan / N. Mohan / N. Mathivanan
Second Semester							
LIF C106	Dissertation and Viva-Voce	C	-	-	-	21	Supervisor

P.G.DIPLOMA IN HERBAL PRODUCTS STANDARDIZATION

Course Code	Course title	Credits			
		L	T	P	C
SEMESTER I					
LIF C076	Introduction to methods of drug evaluation	4	0	0	4
LIF C077	Biological testing of herbal drugs – I	4	0	0	4
LIF C078	Biological testing of herbal drugs – II	4	0	0	4
LIF C079	Practical I	0	0	3	3
LIF C080	Practical II	0	0	3	3
SEMESTER II					
LIF C081	Phytochemical testing of herbal drugs	4	0	0	4
LIF C082	Toxicological testing of herbal drugs	4	0	0	4
LIF C083	Quality control of herbal drugs	4	0	0	4
LIF C084	Project and viva-voce	0	0	6	6

POST GRADUATE DIPLOMA IN HERBAL PRODUCTS STANDARDIZATION**SEMESTER I**

LIF C076	Introduction to methods of drug evaluation	4	0	0	4
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Introduction to drug standardization, Basics of Practical Biochemistry Pharmacognosy-morphological, taxonomical, microscopical, preservation of herbs and herbal sources Physical evaluation – moisture content – viscosity – melting point – solubility – optical rotation – refractive index – ash values and extractives – ash content – water soluble and alcohol/ether soluble extractives – volatile oil content – foreign organic matter. Chemical evaluation– isolation – purification – identification of active constituents – different methods such as titrimetry – gravimetric – spectroscopic analysis – UV visible – infrared and fluorimetric analysis Biological evaluation – bioassay – toxicity

LIF C077	Biological testing of herbal drugs – I	4	0	0	4
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Hepatoprotective and Hypoglycemic activities Antifertility testing – female – antispermato-genic activity – spermicidal activity Anti-inflammatory activity Pharmacological activity – testing the effects of herbal drug extracts in autonomic nervous system with different issues.

LIF C078	Biological testing of herbal drugs – II	4	0	0	4
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Antimicrobial activities – antibacterial – antifungal – antiparasitic and antiviral studies Microbial assays based on the measurement of diameter of the microbial growth inhibition – turbidometric assay Insecticidal or insect repellent activity – larvicidal and adulticidal activities, Immunomodulatory potentials

LIF C079	Practical I	0	0	3	3
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Identification and preservation of herbs – Identification of microbial contaminants , microbial load, fibre content, stability of a product/shelf-life - Basic *in vitro* biological tests

SEMESTER II

LIF C080	Practical II	0	0	3	3
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Isolation and purification of active components – Extraction – column chromatography – TLC – HPTLC – Electrophoresis – Analysis of their biochemical properties – moisture – ash fiber content, qualitative determination of components – carbohydrate, lipid, vitamin mineral, antioxidants, herbal enzymes and hormones.

LIF C081	Phytochemical testing of herbal drugs	4	0	0	4
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Preliminary Phytochemical screening – Successive solvent extraction – Qualitative chemical examination – detection of alkaloids, carbohydrates and glycosides, oils and fats, saponins phenolic compounds and tannins, proteins, proteins and free amino acids, gums and mucilages and volatile oils, antioxidant evaluation

LIF C082	Toxicological testing of herbal drugs	4	0	0	4
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Use of animals and tissue culture/cell lines for toxicology testing – acute, subacute and chronic toxicology studies

LIF C083	Quality control of herbal drugs	4	0	0	4
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Botanical – Physio-chemical – Pharmacological – Toxicological – Microbial contamination – Radioactive contamination – Pharmacopical regulations

LIF C084	Project and viva-voce	0	0	6	6
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P.G.DIPLOMA IN HERBAL BIOTECHNOLOGY

SEMESTER I					
LIF C276	Herbal Biotechnology	4	1	0	5
LIF C277	Cloning Vectors	4	1	0	5
LIF C278	Herbal biotechnology -practical	0	2	4	6
SEMESTER II					
LIF C279	Genetic Engineering	4	1	0	5
LIF C280	Bioinformatics	4	1	0	5
LIF C281	Project/Dissertation	0	0	10	10

SEMESTER I

LIF C276	Introduction to Herbal Bio-technology	3	0	0	3
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1. Medicinal And Aromatic plants – Aromatic plants – Aromatic compounds from cultured cells, tissues and organs. Anticancer Drugs from plants.
2. Lignans: Promising anticancer agents. Taxol: Chemistry, bioactivity and biotechnology-antimalarial drugs of plants origin.
3. plant biotechnology in the cure of AIDS, biotechnological approaches for mass propagation.
4. Conservation of medicinal plants and aromatic plants, Biotechnological perspectives of secondary metabolites of medicinal plants.
5. Production of secondary metabolites in bioreactor

	Molecular Biology and Genetic Engineering	3	0	0	3
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1. Cloning vectors (phages-plasmid-Cosmid)-Replication – Transcription – Translation in prokaryotes and Eukaryotes – Restriction Endonucleases – ligation of DNA fragments.
2. Cloning in Yeast *Sachaomyces cerevisiae* genetics – Here cycle – types of vectors – gene expression system. Cloning an gene expression in Streptomyces
3. Cloning promoters and terminators. *Agrobacterium tumefaciens* – Ti plasmid – molecular genetics and gene expression
4. Expression vectors – vectors vectors for fusion protein – promoters – translation – proteases – gene fusion – secretion – modification and protein refolding – inducible/constitutive expression cassettes – Impact of gene cloning and Bioethics.

	Phytopharmaceuticals	3	0	0	3
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1. Concept of stereo-isomerism – chemistry, biogenesis and pharmacological activity of medicinally important monoterpenes sesduiterpenses, diterpenes and triterpenoids – gibberellins, steroid, coumarins, phenols and phenolic acids, phenyl propanoids, Flavanoids and neoflavonids, Flavonoids and Flavones, Anthocyanins, Xanthones, Stibenes, Tannis and quinines, lignins, glycosides, organic acids, lipids and related compounds.
2. Nitrogen compounds, aminoacids, amines, alkaloids, indoles, purines, pyrimidines and cytokinins, chlorophylls, sugar derivatives, macromolecules.

LIF C278	Herbal Biotechnology – Practical (Papers I, II & III)	0	0	5	5
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1. Isolation and identification of the above compounds
2. Plant genome DNA Isolation, Lambda library construction
3. Cloning of DNA into expression vectors-transformation of microbes
4. PCR – based cloning – library screening –southern hybridization

- Use of radioactive and nonradioactive probes – SI mapping – DNA sequencing – genome analysis in micro-and phyto – subjects – Site directed mutagenesis.

SEMESTER II

	Herbal Biotechnology – Recent Advances & Potential of Medicinal Plants	3	0	0	3
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- Biosynthesis in cultured plants cells. Biotransformation by cultured plant cells.
- Transformed root culture – Elicitation – Metabolic engineering – Bioreactors for plant cell culture – Production of vaccines by transgenic plants – Plant biotechnology in aid of AIDS.
- Biotechnological approaches for the development of anticancer drugs from plants – Rapid propagation of medicinal and aromatic plants in liquid media in a novel culture vessel.
- Bioreactive compounds from immobilized plant cells.

	Introduction to Bioinformatics	3	0	0	3
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- Genomics and DNA sequences and output management from different biological output sources, gene prediction rules and software
- Gene therapy, analysis of genomic and proteomic information with respect to biological systems – Genome applications – pathway regulatory networks.
- Drug design/discovery and identification, synthesis of new drugs; management of diverse chemical libraries.
- Microarrays and recent developments in expression analysis: Involvement of single/multiple Gene(s) and Metabolic pathways: Cluster Analysis and co-regulated Genes; Applications of Microarrays in Drug Toxicity Testing, Metabolic pathways.

	Practical (Papers V & VI)	0	0	3	3
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- Plant Tissue culture – Media preparation – Micropropagation – Organogenesis – Isolation natural products from cultured plant cells – Biotransformation by cultured plant cells – Root culture – metabolic engineering in Medicinal Plants – Bioreactors – Polymerase chain reaction; Expression systems and their applications.
- Containment facilities for Genetic engineering experiments, regulations of field experiments and release of GMO's (Genetically Modified Organisms), labeling of GM (Genetically Modified) Foods.
- Principle Computer applications – Computer aided drug design – phylogenetic analysis package – creation of database.

LIF C281	Dissertation & Viva-Voce (4+1)	0	0	0	5
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P.G.DIPLOMA IN MEDICINAL AND AROMATIC PLANTS

Course Code	Course Title	Credits			
		L	T	P	C
Semester – I					
LIF C376	Introductory Botany	4	0	0	4
LIF C377	Phytochemistry	4	0	0	4
LIF C378	Laboratory Course in Analytical phytochemisrty	2	0	0	2
LIF C379	Practical	0	0	4	4
Semester – II					
LIF C380	Biotechnology of medicinal and aromatic plants	3	0	0	3
LIF C381	Pharmacology and Toxicology	3	0	0	3
LIF C382	Practical	0	0	4	4
LIF C383	Dissertation & Viva Voce	0	0	4	4

LIF C376	Introductory Botany	4	0	0	4
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- Introduction and importance of medicinal and aromatic plants.
- History of herbal medicine.
- Principles of classification and taxonomy of medicinal and aromatic plants
- Chemosystematics.

LIF C377	Phytochemistry	4	0	0	4
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1. Concept of stereo – isomerism – chemistry, biogenesis and pharmacological activity of medicinally important monoterpenes, sesquiterpenes, diterpenes and triterpenoids – gibberellins, steroids, coumarins.
2. Phenols and phenolic acids, phenyl propanoids, flavonoids and neoflavonoids, flavonoids and flavones, anthocyanins, xanthenes, stilbenes, tannins and quinines, lignins, glycosides, organic acids, lipids and related compounds.
3. Nitrogen compounds, amino acids, amines, alkaloids, indoles, purines, pyrimidines and cytokinins, chlorophylls, sugar derivatives and macromolecules.
- 4.

LIF C378	Laboratory Course in Analytical phytochemistry	2	0	0	2
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Extraction – isolation – characterization – chromatography – spectroscopy – centrifugation – mass production for analysis – complete analysis of entire plants

LIF C379	Practical	0	0	4	4
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1. Collection, identification, characterization of medicinal and aromatic plants.
2. Extraction, estimation and identification of herbal products. Cultivation practices of important medicinal and aromatic plants. Harvesting and processing techniques.
3. Herbarium submission of 50 medicinal plants.

LIF C380	Biotechnology of medicinal and aromatic plants	3	0	0	3
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1. Plant tissue culture and micro propagation
2. Genetic engineering of medicinal plants – direct gene transfer – germplasm storage – gene bank – development of transgenic medicinal plants – development of disease resistant through tissue culture – optimization of process parameters for the production of metabolites by microbial fermentation – standardization of down stream process – biotransformation.
3. Enhancement of bio – active principles through biotechnology – cryopreservation.
4. Plant cell fermentation and production of secondary metabolites – production of secondary metabolites by immobilized plant cells.

LIF C381	Pharmacology and Toxicology	3	0	0	3
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1. Introduction to pharmacology – sources of drugs and routes of administration, mechanism of action – combined effect of drugs and drug action, tolerance and dependence, pharmacology of peripheral nervous system, central nervous system, cardiovascular system, hemopoietic system, drugs acting on urinary system – autotoxins – drugs acting on respiratory system, gastrointestinal tract, endocrinal system.
2. General principles of toxicology – food toxicology.

LIF C382	Practical	0	0	4	4
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1. Tissue culture – micropropagation through callus, development of haploid plant through anther / stigma. Meristem culture and embryo culture.
2. Direct and indirect gene transfer (vector mediated), biolistic gun, cryopreservation, testing for anticancer property (Mouse as model system).

LIF C383	Dissertation & Viva Voce	0	0	4	4
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Project report on any one of the important areas of medicinal or aromatic plants, visits to herbal farms, medicinal gardens, industries.

P.G.DIPLOMA IN MOLECULAR CELL BIOLOGY AND STEM CELL TECHNOLOGY

Course code	Course Title	Credits
SEMESTER I		
LIF C576	Biochemistry	3
LIF C577	Molecular Developmental Biology	4
LIF C578	Molecular Cell biology	4
LIF C579	Practical – I (Covering LIF C576, LIF C577& LIF C578)	3
SEMESTER II		
LIF C580	Molecular Biology of Gene	4
LIF C581	Stem cell Technology	4
LIF C582	Bioinformatics	3
LIF C583	Practical – II (Covering LIF C580 & LIF C581)	3

LIF C576	Biochemistry	3
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1. Carbohydrates: Isomerism, epimers, homoglycan and heteroglycan polysaccharides, mucopolysaccharides, LPS, blood group antigens. Key regulatory pathways in glycolysis, regulatory pathways in TCA cycle.
2. Proteins: Protein foldings, intramolecular forces stabilizing protein conformation, molecular chaperons, higher order protein structures, isoelectric pH, denaturation and renaturation, protein stability and protein families, Post translational modifications of proteins, urea cycle. Compartmentalisation, coenzymes in intermediary metabolism, isozymes, allosteric and co-operative effects, feedback inhibition.
3. Lipids: Lipid Biosynthesis and Acetyl-CoA carboxylase, triacyl glycerol transport, phospholipids, sphingolipids, Leuckotriens, thromboxiens prostaglandins and bile acids. Role of malonyl CoA in beta - oxidation.
4. Nucleic Acids : DNA, DNA–Replication, DNA-Repair, DNA double helix, Structure of RNA, Enzymatic synthesis of RNA.
5. Biological Oxidation: Oxidation and reduction, cytochromes, superoxide metabolism, oxidative burst, chemiosmotic theory, decouplers and free radicals scavengers.

LIF C577	Molecular Developmental Biology	4
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1. Pattern of Development: Fertilization : Molecular recognition of egg and sperm, species specific recognition, fusion and prevention of polyspermy, rearrangement of egg cytoplasm and activation of egg
2. Cleavage: Cleavage furrow, mid-blastula transition, regulation of cleavage cycle. Gastrulation: Acquisition of cell motility and movements, role of fibronectin in mesodermal migration.
4. Early Vertebrate Development: Primary and secondary neurulation, molecular mechanism of vertebrate eye development, neural crest cells- migration and derivatives, axonal pathway- selection, growth, target innervation and the role of ECM and diffusible molecules in axonal growth. Differentiation of notochord and somites, myogenesis, hematopoiesis.
5. Developmental Genetics: A case study with *Drosophila* – Maternal effect genes – genetic regulation of pattern formation – role of homeotic genes in segment specifications.
2. Cell-Cell Interaction: Progressive determination of embryonic cells, Nieuwkoop center, molecular role of organiser. Instructive and permissive interactions, competence, epithelial- mesenchymal interactions, morphogenesis of kidney, induction at single cell level- differentiation of photoreceptors in ommatidia and vulval induction in *C.elegans*.

LIF C578	Molecular Cell biology	4
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1. Introduction : Origin of single cell – theories and concepts. Cell environment : Extra cellular matrix (ECM), glycocalyx, basal lamina, components of ECM – fibronectin, laminin, collagen, heparan sulfate proteoglycans, role of ECM in cell growth and survival. Cell-Cell adhesion : Cell junctions, tight junctions, desmosomes, connexins selectins, integrins, Ig superfamily and cell-cell adhesion in cancer. Contact inhibition. Cytoskeleton : Microfilaments, actin cytoskeleton, G and F actin, dynamics of actin assembly and polymerisation, myosin and molecular motors. Microtubules: structure and dynamics, microtubular organizing centers, dynamic instability, microtubule associated proteins (MAPs) Kinesin, Dynein and intracellular transport, Kinetochore architecture and spindle assembly, focal adhesion points, microvilli and pseudopodial extensions. Intermediate filaments: types and function

2. Proteins sorting : Golgi and endoplasmic reticulum and lysosome complex in protein targeting, signal recognition particle chaperons and protein folding,. GPI anchoring targetting of proteins to mitochondria, protein glycosylation and post-translational modifications, vesicular transport and secretory pathways basis of lysosomal storage diseases.
3. Cell-Cell Communication : Models of cell signalling, autocrine, paracrine, endocrine, steroids and juxtacrine communication, Nitric oxide and carbon monoxide paracrine factors involved in communication- FGF's, Hedgehog family Wnt family TGF-beta superfamily BMP family. Signal transduction pathways: G-protein, cAMP pathway IP3 pathway, RTK pathway, Smad pathway, JAK-STAT pathway, Wnt Pathway. RTK dimerization and autophosphorylation, SH2 domains. MAP kinase pathway.
4. Cell cycle : Pro and eukaryotic cell cycle, cell growth and extracellular signal molecular basis of cell cycle regulation, cell cycle checkpoints, cyclin and cyclin dependent kinases, Rb regulation exit from the cell cycle, MIS-MPF and M-phase events. Apoptosis : Survival and death factors cell death receptors cell-cell interactions in cell rescue and death, erythropoietin in RBC development. Molecular apoptotic events in *C. elegans* and mammals, bcl family of proteins, caspases, significance of apoptosis.
5. Cancer biology : Etiological factors, primary secondary tumors benign and malignant forms. Oncogene : proto oncogene and viral oncogene , oncogene activation tumour supressor genes, DNA tumour viruses, tumour specific antigens and tumour evasion. Metastasis: molecular event migration – extravasation, chemokines role of ECM in metastasis. Angiogenesis; angiogenetic and antiangiogenetic factors, vasculogenesis.

LIFC 579	Practical-I (Covering LIF C576, LIF C577& LIFC578)	3
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1. Isolation of plasmid DNA
2. Restriction digestion
3. Agarose gel electrophoresis of DNA
4. Genomic DNA extraction
5. Preparation of competent *E. Coli*.
6. Transformation of plasmid DNA
7. PCR
8. Western Blotting and development
9. Southern blot and hybridization
10. Development of frog, chicken, Sea urchin or hydroids
11. Isolation of cell organelles
12. Enzyme Kinetics

LIF C580	Molecular Biology of Gene	4
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1. Nucleic acids- Primary, secondary and tertiary structures, DNA-helical conformations and polymorphism, DNA topology, nucleic acid quarternary structure, non-covalent forces, DNA as the genetic material, denaturation and renaturation.
Nucleic acid recognition by proteins, DNA- and RNA-binding motifs, molecular aspects of proteins-nucleic acid binding, sequences specific binding.
3. Concept of gene, gene-cistron relationship, cis-trans test, structure of prokaryotic and eukaryotic transcriptional units, basal and constitutive components of initiation, basal transcriptional factors, promoter-polymerase interaction, sigma factors, role of regulatory elements –promoters and enhancers, locus control regions, transcriptional elongation and termination, role of secondary structures and rho in termination, anti-termination.
4. mRNA processing in pro and eukaryotes, polyadenylation, RNA splicing, alternative splicing, RNA editing, post-processing regulations-RNA export and localization, RNA turnover and retro-regulation, intron encoded proteins.
5. Prokaryotic and eukaryotic replicons, DNA replication and cell cycle regulation, molecular structure of replicons, rolling cycles and D-loop models, primosome and initiation of replication.

LIF C581	Stem cell Technology	4
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1. Stem cell concept, Embryonic stem cells, Adult stem cells, the problem of differentiation, totipotency, pluripotency, haematopoietic stem cells.
2. Differentiation status of cells – primordial germ cells, skin cells, gastrointestinal cells, haematopoetic germ cells, liver cells, sertoli cells, and neurons.
3. Stem cell location and classification, Stem cells niches-germ line, epithelial, epidermal, and neural niches.
4. Interactions between signaling pathways in transformation, differentiation and Trans differentiation.
5. Uses of stem cells: stem cells and cancer treatment, stem cells and tissue engineering, gene therapy and embryonic stem cells, therapeutic cloning.
6. Ethical and social considerations of stem cell research.

LIF C582	Bioinformatics	3
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1. Introduction to information theory of biology- Networking, websites and servers, operating systems-perl programming , Java.
 2. Database in biology, computation in statistical analysis, remote sensing, and imaging.
- Computational methods in molecular biology-Computational algorithms.
Supporting genomic research, DNA sequence comparisons and assembly for hybridisation mapping, gene hunting.
Phylogenetic reconstruction, genome rearrangement, introduction to protein folding and threading software, C++, XML.

LIF C583	Practical – II (Covering LIF C580 & LIF C581)	3
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1. Centrifugation principles, preparative and analytical centrifuges, differential and density gradient centrifugation.
2. Cell fractionation techniques, cell sorting and cell counting, cryopreservation, microscopy, flow cytometry.
3. Chromatography- Column chromatography, column efficiency and solution absorption chromatography, partition chromatography, normal phase and reverse phase chromatography, paper chromatography, ion-exchange chromatography, exclusion chromatography, affinity chromatography, GLC, LC, LPLC and HPLC.
4. Electrophoretic principles, zonal and disc electrophoresis ,2-D electrophoresis, high and low voltage electrophoresis, PAGE, isoelectric focusing, PFGE and capillary electrophoresis
5. Spectrophotometer, Spectrofluometry, colorimetry, mass spectrometry, Infra-Red Spectrophotometer.
6. Radio-isotopes, autoradiography, beta counters, scintillation counters.
7. Techniques on protein- nucleic acid interaction: Gel retardation assay, DNase footprinting, modification protection, modification interference.
8. Culture of Stem cells – Differentiation and Trans differentiation experiments.

POST GRADUATE DIPLOMA IN TAXONOMY OF FUNGI

Course Code	Course Title	Credits				Course faculty
		L	T	P	C	
I- Semester LIF C376	Nomenclature and Classification of fungi	2	1	1	4	Prof. N. Raman
LIF C377	Molecular Taxonomy – Molecular approaches to fungal taxonomy	2	1	1	4	Dr. V.Kaviarasan. Dr. K.Periyasamy & Dr. P.Ebenezer
LIF C378	Taxonomy of Zygomycotina, Deuteromycotina	2	1	1	4	Dr. J.Muthumary
II- Semester LIF C379	Taxonomy of Myxomycotina, Ascomycotina	2	1	1	4	Dr. V.Kaviarasan. Dr. K.Periyasamy & Dr. P.Ebenezer
LIF C380	Taxonomy of Mastigomycotina, Basidiomycotina	2	1	1	4	Prof. N. Raman Dr. V.Kaviarasan. Dr. K.Periyasamy
LIF C381	Culturing and cultivation of fungi	2	1	1	4	Dr. V.Kaviarasan. Dr. K.Periyasamy & Dr. P.Ebenezer
III- Semester LIF C382	Economic importance of fungi	2	0	0	2	Prof. N. Raman Dr. V.Kaviarasan. Dr. K.Periyasamy & Dr. P.Ebenezer
LIF C383	Dissertation				6	
LIF C384	Viva-voce				4	

POST GRADUATE DIPLOMA COURSE ABSTRACT

I- Semester LIF C376	Nomenclature and Classification of fungi	2	1	1	4	Prof. N. Raman
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History of Mycology – International rules of nomenclature – Taxonomy of fungi according to Ainsworth (1973) Webster (1986) Species concept – Holotype, isotype, lectotype, syntype - Classification of fungi

LIF C377	Molecular Taxonomy – Molecular approaches to fungal taxonomy	2	1	1	4	Dr. V.Kaviarasan. Dr. K.Periyasamy & Dr. P.Ebenezer
LIF C378	Taxonomy of Zygomycotina, Deuteromycotina	2	1	1	4	Dr. J.Muthumary
LIF C379	Taxonomy of Myxomycotina, Ascomycotina	2	1	1	4	Dr. V.Kaviarasan. Dr. K.Periyasamy & Dr. P.Ebenezer
LIF C380	Taxonomy of Mastigomycotina, Basidiomycotina	2	1	1	4	Prof. N. Raman Dr. V.Kaviarasan. Dr. K.Periyasamy
LIF C381	Culturing and cultivation of fungi	2	1	1	4	Dr. V.Kaviarasan. Dr. K.Periyasamy & Dr. P.Ebenezer

Methods for the isolation and culturing of fungi from soil, leaf and litter – endophytic fungi – cultivation of edible and medicinally important mushrooms, *Agaricus*, *Pleurotus*, *Volvaria*.

III- Semester LIF C382	Economic importance of fungi	2	0	0	2	Prof. N. Raman Dr. V.Kaviarasan. Dr. K.Periyasamy & Dr. P.Ebenezer
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Antibiotics – Organic acids – enzymes, amylase, protease, lipase – taxol production.

Practicals:

Collection, identification, characterization of genera belonging to Myxomycotina, Mastigomycotina Zygomycotina, Ascomycotina, Basidiomycotina and Deturomycotina with special reference to important genera and species in various groups (at least-5 for each group). Standard reference manuals and Monographs will be used for identification of the various species.

POST-GRADUATE DIPLOMA IN TAXONOMY OF ALGAE

Subject code	Title of the course	C/ E	Credits			Course faculty	
			L	T	P	C	
I Semester LIF C476	Nomenclature and Classification of Algae	C	2	1	1	4	Prof. N. Anand Prof. R. Rengasamy
LIF C477	Taxonomy of Algae –I	C	2	1	1	4	Prof. N. Anand Prof. R. Rengasamy
LIF C478	Taxonomy of Algae –II	C	2	1	1	4	Prof. N. Anand Prof. R. Rengasamy
II Semester LIF C479	Taxonomy of Algae -III	C	2	1	1	4	Prof. N. Anand Prof. R. Rengasamy
LIF C480	Taxonomy of Algae -IV	C	2	1	1	4	Prof. N. Anand Prof. R. Rengasamy
LIF C481	Culturing and cultivation of algae	C	2	1	1	4	Prof. N. Anand and Prof. R. Rengasamy
III Semester LIF E476	Economic Importance of Algae	E	2	0	0	2	Prof. N. Anand and Prof. R. Rengasamy
LIF C482	Dissertation	C				6	
LIF C483	Viva-Voce	C				4	

POST GRADUATE DIPLOMA COURSE ABSTRACT

LIF C476	Nomenclature and Classification of Algae	C	2	1	1	4	Prof. N. Anand Prof. R. Rengasamy
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International Code of Botanical Nomenclature, Species concept – Epitype, Extype, Holotype, Isotype, Lectotype, Monotype, Neotype, Paratype, Syntype, Topotype and Typotype, Classification of Algae: Fritsch, Smith, Chapman and Chapman, Christensen, Bold and Wynne and Silva. Modern approaches to Algal Taxonomy and Systematics. Fixatives –Preparation of semi permanent and permanent slides. Preparation of herbaria.

LIF C477	Taxonomy of Algae –I	C	2	1	1	4	Prof. N. Anand Prof. R. Rengasamy
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Fresh water and marine environments - General features of Morphology, Ultrastructure, Reproduction and life histories of Algae.

LIF C478	Taxonomy of Algae –II	C	2	1	1	4	Prof. N. Anand Prof. R. Rengasamy
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General features of Morphology, Ultrastructure, Reproduction and life histories of the orders with suitable examples from Cyanophyceae, Rhodophyceae, Xanthophyceae, Eustigmatophyceae and Dinophyceae.

LIF C479	Taxonomy of Algae -III	C	2	1	1	4	Prof. N. Anand Prof. R. Rengasamy
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General features of Morphology, Ultrastructure, Reproduction and life histories of the orders with suitable examples from Chrysoophyceae, Haptophyceae, Bacillariophyceae, Phaeophyceae.

LIF C480	Taxonomy of Algae -IV	C	2	1	1	4	Prof. N. Anand Prof. R. Rengasamy
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General features of Morphology, Ultrastructure, Reproduction and life histories of the orders with suitable examples from Prochlorophyceae, Chlorophyceae, Prasinophyceae, Charophyceae, and Euglenophyceae.

LIF C481	Culturing and cultivation of algae	C	2	1	1	4	Prof. N. Anand and Prof. R. Rengasamy
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Laboratory and mass culturing of micro algae : *Spirulina, Chlorella, Hemaetococcus, Dunaliella* – mass cultivation of marine macro algae: *Gracilaria, Gelidiella, Kappaphycus*

LIF E476	Economic Importance of Algae	E	2	0	0	2	Prof. N. Anand and Prof. R. Rengasamy
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Biofertilizer, single cell protein, carotenoids, astaxanthin, phycocyanin, seaweed liquid fertilizer, phycocolloids – agar, algin, carrageenan.

Practicals: Semester I and II: Identification of the taxa using Manuals and Monographs.

P.G.DIPLOMA IN PHARMACEUTICAL BIOTECHNOLOGY

SEMESTER I							
LIF C282	Genomes, Drugs and Bioinformatics	4	1	0	5		
LIF C283	Pharmaceutical Biotechnology	4	1	0	5		
LIF C284	Practical - Computational analysis of DNA and protein sequences- Screening of Drug Databases	0	2	4	6		
SEMESTER II							
LIF C285	Biotechnology of Biopolymers	4	1	0	5		
LIF C286	Microarrays for an integrative genomics	4	1	0	5		
LIF C287	Project/Dissertation	0	0	10	10		

LIF C282	Genomes, Drugs and Bioinformatics	4	1	0	5		
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Unit I : Genome features –Genome shape and size – Gene content and organization – base composition – codon use – Replication and expression The molecular basis of disease – The molecular approach to curing diseases – Finding protein targets .

UnitII : Genomics vs proteomics –genes/proteins – Developing drugs – A bioinformatics landscape – The intrinsic view – The extrinsic view –molecular biology database and genome comparison –Gene and protein expression data –Drug screening –Genetic variability.

Unit III: Protein-Ligand Docking in Drug Design.-A taxonomy of docking problems-structure-based drug design – methods for protein-ligand docking –Docking by simulation – Docking of combinatorial libraries – Scoring protein-ligand complexes – Validation studies and applications – Validated blind predictions – Software accessibility.

Unit IV: Target finding in Genomes and proteomes; Experimental design for large-scale gene expression studies and drug target identification –

UnitV: Computational analyses in drug target discovery –Clustering – Combining analytical methods in the development of experimental therapies –reverse engineering of genetic networks.

LIF C283	Pharmaceutical Biotechnology	4	1	0	5	
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- Unit I: Introduction to concepts and technologies in pharmaceutical Biotechnology pharmaceutical Biotechnology and industrial applications. - Prokaryotic and eucaryotic cells in Biotech production.- Biopharmaceuticals expressed in plants
- Unit II: Industrial development and production process. scientific, technical and economic aspects of vaccine research and development.- DNA vaccines: from research tools in mice to vaccines for humans
- UnitIII: Characterization and bioanalytical aspects of recombinant proteins as pharmaceutical drugs-Biogenic drugs.
- UnitIV: Therapeutic proteins – special pharmaceutical aspects. Pharmaceutical and pharmacodynamics of biotech drugs- Formulation of biotech products.
- Unit V : Rituximab: clinical development of the first therapeutic antibody for cancer-somatic gene therapy – advanced biotechnology products in clinical development-Nonviral gene transfer systems in somatic gene therapy- Xenotransplantation in pharmaceutical biotechnology

LIF C284	Practical - Computational analysis of DNA and protein sequences- Screening of Drug Databases	0	2	4	6	
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Isolation of high molecular weight plant/animal/microbial genomic -Restriction fragment length polymorphism (RFLP)-Isolation of molecular markers using random amplified polymorphic DNA (RAPD)-PCR-Identificaton of proteins by Two-dimensional polyacrylamid gel electrophoresis (PAGE) –Separation techniques-HPLC-Cloning of DNA into vectors –Computational analysis of DNA and protein sequences – Internet basics – Sequence analysis – integrated information retrieval – Multiple alignment, sequence motifs, and structure inference – Submitting Data To Public databases- Methods for protein-ligand docking – Rigid-body docking algorithms – Preparing input data – Analyzing docking results –Software accessibility – Methods for virtual screening – Ligand similarity-based virtual screening – Structure-based virtual screening – Practical virtual screening –application of fast similarity searching algorithms.

LIF C285	Biotechnology of Biopolymers	4	1	0	5	
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- Unit I: Lignin and Coal synthesis of lignin in transgenic and mutant plants-biotechnological applications of lignin-degrading fungi (white-rot fungi)-biotechnological conversion of coals into upgraded products
- Unit II : Polyisoprenoids & polyesters metabolic pathways and engineering of PHA biosynthesis.-fermentative production of short chain length PHAs. and medium chain length PHAs.-production of polyhydroxyalkanoates in transgenic plants.
- Unit III: Polysaccharides bacterial cellulose-Bioemulsans: surface active polysaccharides containing complexes-curdlan-Succinoglycan-Alginates from bacteria-Xanthan.-Dextran-Hyaluronan-Exopolysaccharides of lactic acid bacteria-Sclerogucan.-Schizophyllan
- Unit IV: Polyamides and complex proteinaceous materials. Cyanophycin-poly-γ-glutamic acid-modification of proteins and poly(amino acids) by enzymatic and chemical methods-Biology and technology of silk production-fibrous proteins from recombinant microorganisms.
- UnitV: Miscellaneous polymers and general aspects. Spider silk proteins from transgenic plants-High-toughness spider silk fibers spun from soluble recombinant silk produced in mammalian cells- seed storage proteins-role of nucleic acid and protein manipulation technologies in high-throughput structural biology efforts.

Alexander steinbuchel and Yoshiharu Doi. 2005. Biotechnology of Biopolymers. From synthesis to patents. Wiley-vch Steinbüchel, Alexander and Doi, Yoshiharu. 2004. Biotechnology of Biopolymers - From Synthesis to Patents. Wiley-VCH.

LIF C286	Microarrays for an integrative genomics	4	1	0	5	
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- UnitI : Introduction – Functional Genomics – Gene clustering Dogma
- UnitII: Microarray measurement to Analyses – Generic features of Microarray technologies –Reproducibility across repeated microarray experiments.
- Unit III: The human genome project and Irreproducibility of expression measurements – inter array and intra array introduction – Hierarchy of Bioinformatics Algorithms –Phylogenetic Type Trees - Relevance networks and other methods .
- Unit IV: Bioontologies, Data models, Nomenclature – Ontologies - Expressivity versus computability – Ontologies versus data model versus nomenclature –the unique gene identifier.
- UnitV: From functional genomics to clinical relevance – Electronic medical records standardized vocabularies for clinical phenotype – privacy of clinical data – costs of clinical data acquisition.

LIF C287	Project/Dissertation	0	0	10	10	
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CERTIFICATE IN HERBAL FARMING

Course Code	Course Title	L	T	P	C
LIF C301	Introduction to Herbal Science	2	0	0	2
LIF C302	Herbal farming techniques (Agrotechniques)	2	0	0	2
LIF C303	Herbal farming techniques	2	0	0	2
LIF C304	Introduction to herbal informatics	2	0	0	2
LIF C305	Practical	6	0	0	6
LIF C306	Dissertation	4	0	0	4

LIF C301	Introduction to Herbal Science	2	0	0	2
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1. History of Herbal Medicine
2. Importance of medicinal plants
3. Principles of classification and taxonomy of medicinal plants
4. Biodiversity and preservation

LIF C302	Herbal farming techniques (Agrotechniques)	2	0	0	2
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1. Methods of propagation – vegetative propagation (Types of cuttings– Slips, Rhizomes, air layering, grafting et.)
2. Seed propagation methods, selection of quality seeds, seed germination studies, physiology and chemistry of seed germination, different types of germination – epigial, hypogeal germination.
3. Factors influencing seed germination (plant growth hormones like IAA, Naa, IBA, GA₃ on germination, Nutrients – essential nutrients, micro and macro nutrients, fertilization (chemical and bio) and pesticides for insect and disease management, soil testing)
4. Plant functions – primary and secondary metabolism, secondary plant products and their uses.
5. Agrotechniques – (weeding – irrigation, inter cultivation) harvesting and post harvest technology.
6. Vegetative propagation, seed germination (*in vitro*, *in vivo*) preparation of land for cultivation.
7. Nursery – line planting, harvesting and storage techniques.

LIF C303	Herbal farming techniques	2	0	0	2
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1. Cultivation of medicinal plants – *Phyllanthus amarus*, *Terminalia arjuna*, *Andrographis paniculata* and *Gymnema sylvestre*.
2. Agricultural practices – ploughing, weeding, watering, seeding process, leveling of land, soil mixing, planting, harvesting, drying, storing, processing, marketing.
3. Pest and disease management.

LIF C304	Introduction to herbal informatics	2	0	0	2
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1. Definition and concept of informatics.
2. Herbal farming and informatics age.
3. Basics of computers.
4. Type of information resources.

LIF C305	Practical	6	0	0	6
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Collection, identification, characterization of medicinal plants in natural habitats. Herbarium submission of herbal plants (50 Nos). Agro cultivation - Land preparation – propagation methods – nursery development – planting stock and planting – calendar of planting – harvesting and post harvest operations – storage and marketing – spacing and sowing – manuring and fertilizers – irrigation – weeding techniques – plant protection measures – inter crop systems.

LIF C306	Dissertation	4	0	0	4
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