DEPARTMENT OF PLANT BIOLOGY AND BIOTECHNOLOGY

M.PHIL PLANT BIOLOGY AND BIOTECHNOLOGY

M.PHIL PROGRAMME

SYLLABUS

Effective from the Academic Year 2016-2017

Loyola College (Autonomous)

Chennai- 600 034

DEPARTMENT OF
PLANT BIOLOGY AND BIOTECHNOLOGY

M.Phil. Restructured Syllabus

(Effective from 2007-08)

Total Credits : 36

Semester	Nature	Code	Course Title	Credits
I	MC	BT 1115	Research Methodology	6
	MC	BT 1116	Plant Biotechnology /	6
	MC	BT 1117	Microbial Biotechnology	
	ES	BT 1151	Plant Microbe Interaction	6
	ES	BT 1152	Plant Genetic Engineering	(any one)
	ES	BT 1153	Microbial Diversity	
	ES	BT 1154	Plant Diversity	
	ES	BT 1155	Environmental Biotechnology	
	ES	BT 1156	Clinical Biochemistry	
	ES	BT 1157	Medicinal Plants	
II	MC	BT 1211	Dissertation & Viva Voce	18

SEMESTER - I

Paper I : BT 1115 Research Methodology - 6 Credits

Paper II : BT 1116 (Optional)-Students can choose any one either plant Biotechnology or microbial Biotechnology - 6 Credits

Paper III : BT 1151-BT 1157 Internal Paper – decided by the Guide - 6 Credits

II semester : BT 1211 - Project and Viva Voce - 18 Credits

BT 1115 : RESEARCH METHODOLOGY

Paper - I

Semester – I Credits : 6

Course : Major Core(MC) Hours/week : 7

Objectives : The course aims to provide the basic knowledge used in research programme. It imparts the fundamental aspects on principle,

methodology and applications of the recent techniques employed in research field.

Unit 1 pH, Buffers and Manometry :

pH, buffers and buffer action: acid-base theories. Strong acids and bases-neutralization, preparation of standard solutions. Weak acids and bases, and their salts. Buffering mechanisms-choice and preparation of common buffers. pH measurements- Principles of operation types of electrodes: reference, glass and combined electrodes., ion-specific electrodes. Manometric and polorcgraphic techniques: principles and applications. Oxygen and carbondioxide analyzers.

Unit 2 Separation Techniques and Cell fractionation methods:

Centrifugation: Principles of sedimentation – Relative stoke's law centrifugal force or field –Soft copy Types of centrifuges-Types of rotors-zonal and isopyenic centrifugation. Isolation of mitochondria, chloroplasts and nucleic acids. Cell fractionation methods-sclid shears, liquid shear, high pressure extrusion and ultrasonic oscillation. Preparation of cell free extracts and crude enzymes.

Chromatographic techniques: principles and application paper, column, thin-layer chromatography- Gel filtration or molecular exclusion chromatography, ion exchange and high performance liquid chromatography, Dialysis and Lyophlization. Electrophoretic techniques: general principles-Gel electrophoresis – Types- SDS PAGE and Agarose-Determination of Molecular weight – Iso electric focusing.

Unit 3 Spectrophotometric and Tracer Techniques

Spectrophotometric techniques: electromagnetic spectrum-absorption of radiation-Instrumentation, Bear-Lamber's law – selection of wave length Monochromators, prisms. Diffraction and holographic gratings-Absorbance, transmittance and concentration modes- Light sources: Ultra violet and visible spectrophotometers- single and double beam, double wavelength spectrophotometers. Principles and application of infrared spectrometers, atomic absorption spectrometer, plasma emission spectroscopy,

luminometry and densitometry. Spectrometric assay of enzymes – Measurement of enzyme kinetics-catalase, amylase and prolease. Tracer techniques: Half time, types of radioactive decay-Measurement of radioactivity. Application of tracer techniques in biological research. Stable isotopes and their uses.

Unit 4 : Molecular techniques and Bioethics

Restriction Fragment Length Polymorphism (RFLP) and Polymerase Chain Reaction (PCR)- application. Molecular Probes: Serological probes (monoclonal antibodies) and nucleic acid (DNA) probes-methods of making and application in diagnostics. Molecular marking systems. Southern, Northern and Western blotting techniques. Dot and slot blots. Enzymes used in genetic manipulation- restriction endonucleases and ligases. Homopolymer tailing. Cloning vectors: viral DNA, plasmids, cosmids, vectors of eukaryotes and their uses in transfer of DNA-DNA sequencing.

Bioethics: Introduction to biosafety- classification of biological risk material-risk of genetically modified organisms. Technology protection system:GURT and terminator technology. Laboratory biosafety level criteria-laboratory security and emergency response, detection and control. International Protocols on biosafety. Intellectual Property Right (IPR) and Protection (IPP). Patenting of biological materials.

Unit :5 Data analysis and information retrieval

Collection and presentation of data: Statistical methods-measures of dispersion, probability, simple correlation and regression. Fundamentals of normals, binominal and Poissien distribution. Population and methods of sampling- analysis of variance. Information retrieval-preparation of manuscripts. Use of computers in biology- Internet- Basics of informatics.

Text Books:

1. Keith Wilson and John walker - Practical Biochemistry Principles and techniques. Cambridge University Press., 2004

2. Keithk Wilson and J.O. Goulding - A Biologist guide to Principles and techniques of Practical Biochemistry. Edward Arnold (Pub.) Ltc., 1986

References :

1. Cambelt I.D. and Dwek R.A - Biological spectroscopy. Benjamin Cummins and Company., 1986
2. Williard and Merrit - Instrumental Methods of Analysis John Wiley & Sons., 1996
3. Skoog. D.A. -Principles of instrumental analysis. Holf- Saunders., 1985
4. Sewell P.A. and Clarke B. -Chromatographic separation. John Wiley and Sons., 1991
5. Harper's Biochemistry
6. Biochemistry by D.Voet & J..G.voet
7. L. Stryer. - Biochemistry, 4th edition, W.H. Freemen & Company, Newyork., 1999
8. R. Rapley & J.M. Walkes - Molecular Biomethodes Hardbooks Humana Press., 1998
9. Principle of Biochemistry by A.L. Lehninger.
10. G.L. Zubay - Biochemistry, 4th edition. Mc Graw- Hill., 1998

BT 1116 : PLANT BIOTECHNOLOGY

Paper - II

Semester – I — Credits : 6

Course : Major Core(MC) — Hours/week : 6

Objectives :

This course aims to make the learner understand the basic plant tissue culture techniques, Genetic, Engineering and Transgenic. This paper also would make the learner to understand the mechanisms of gene expression, its regulation and their applications in the industry.

Unit : 1 Plant Tissue Culture

Introduction – history- laboratory organization- media preparation and aseptic manipulation. Initiation and maintenance of callus, suspension,

culture and single cell clones. Organogenesis and somatic embryogenesis. Haploid production. Somatic hybridization and cybridization-somoclonal variations and application. Micropropagation : shoot tip culture and bud cultures : single node culture and axillary bud culture-zygotic embryo culture- germplasm conservation and cryopreservation.

Unit : 2 Genetic Engineering and r DNA technology

Scope of genetic engineering –brief history of recombinant DNA technology- molecular tools and their application- gene cloning vectors. Gene transfer methods : vector mediated gene transfer – Direct of vector less DNA transfer. Marker genes for plant transformation- promoters and terminators Chloroplast (organelle) transformation.

Unit : 3 Application of plant transformation (Transgencis)

Resistance to biotic stresses : Insert resistance : Bt genes, non- Bt like protease inhibitors, alpha amylase inhibitor. Virtal resistance : coat protein mediated, nucleocapsid gene and antisense RNAs. Disease resistance : chitinase, 1-3 beta glucanase, RIP, antifungal proteins, thionins, PR proteins,. Nematode resistance. Resistance to abiotic stresses : herbicide resistance, phosphinothricin resistance and glyphosate resistance. Improvement of crop yield and quality: long shelf life of flowers, vegetables and fruits. Genetic engineering for flower pigmentation and prevention of flower discoloration. Transgenic plants with improved nutrition- transgenic plants as bioreactor.

Unit : 4 Gene expression and regulation

Prokaryotic transcription-modifications in RNA – translation-regulation of bacterial gene activity: negative inducible control (Lac operon); negative repressible control (Trp operon) ; positive, inducible control (Ara operon) ; global regulation or multiple controls and post translation control. Eukaryotic transcription- translation and post translation modifications- regulation of gene expression : transcriptional regulation of gene; regulation of mRNA processing; regulation of translation; protein stability and activity and multicopy genes.

Unit : 5 Metabolic engineering and industrial products

Plant secondary metabolites, control mechanisms and manipulation of phenyl propanoid pathway, shikmate pathway ; alkaloids, industrial enzymes, biodegradable plastics, polyhydroxybutyrate, therapeutic proteins, lysosomal enzyme, plantibocies, edible vaccines, purification strategies, olesin partitioning technology.

Books for reference :

1. Balasubramanian, D., Bryce, C.F.A., Dhamalingam, K., Green, J.and Kunthala jayaraman - (ed.,) Concepts in Biotechnology. Universities press (India) Ltd., Hyderabad., 1996
2. Geroge M.Malacinski - Freifelder's Essantials of molecular biology, 4th edition. Narosa publishing house Pvt. Ltd. New Delhi., 2005
3. Gupta, P.K. - Elements of Biotechnology. Rastogi Publications, Meerut, India., 2001
4. Ignacimuthu, S - Plant biotechnology, By Raju Primlani for Oxford and IBH publishing co. pvt. Ltd., 2003
5. Khan, I.A., and Khanum, A., -Role of Biotechnology in Medicinal and Aromatic plants. Ukaar publications, Hyderabad., 1996
6. Mascaranhas, A.. F. - Hand book of Plant Tissue Culture. Indian Council of Agricultural Research, New Delhi., 1991
7. Old, R.W., and Primose, S. B., - Principles of Gene Manipulation- An introduction to Genetic engineering, Black well Sciencers Ltd., New York., 1996
8. Reinert,, J. and Bajaj, Y.P.S., - Plant cell, Tissue and Organ culture, Narosa publishing house, New Delhi., 1997
9. Satyanarayana, U. - Biotechnology Books and Allied (P) Ltd., Kolkata. India., 2005
10. Susan L. Elrod and William D. Stansfield - Schaum's outline of theory and problems of Genetics. 4th edition. Tata MeGraw- Hill edition, Delhi., 2002

BT 1117 : MICROBIAL BIOTECHNOLOGY

Paper - II

Semester – I | Credits : 6

Course : Major Core(MC) | Hours/week : 6

Objectives : The course aims at providing knowledge on microbial diversity of industrial importance, production of proteins, biomass, fuels, antibioties, fermentation, organic synthesis and degradation and mineralization.

Unit 1 : Introduction to microbial biotechnology : Microbial diversity and its applications – Principles of Fermentation- Fermentation based industries – Fermentor design and operations- Isolation and improvement of industrially important strains – Substrates for microbial fermentation- preservation of microorganisms.

Unit 2 : Microbes – Living factories for macromolecules : Production of proteins from bacteria, yeast: Production of recombinant drugs (proteins) and synthetic vaccines; Microbial enzymes- Production of Protease and amylase; Production of microbial polysaccharides and polyesters.

Unit 3 : Microorganisms in Agriculture : Plant –microbe interaction; use of symbionts and pathogens; Biofertilizers- Mass Production of BGA a Rhizohium inoculants – microbial insecticides.

Unit 4 : Microbes in bioconversion : Biomass to fuels ; yogurt and cheese production ; metabolites from microbes- aminoacid fermentation; Antibiotics- classification & production of aminoglycosides and - lactams, Production of antifungal, antibacterial and antitumor antibodies.

Unit 5 : Organic synthesis and Degradation: Microbial transformation and application; Environmental applications of microbial technology- sewage and wastewater treatment; microbial degradation of xenobiotics; microbes in mineral recovery and removal of heavy metals from aqueous effluents..

Books of Reference:

1. Alexandar N. Glazer and Hiroshi Nikaida - Microbial Biotechnology: Fundamentals and applied microbiology. W.H. Freeman and Co, New York., 1981
2. F. Crueger and Anneliese Cruger -Biotechnologh : Industrial Microbiology. Panima Publications., 2001
3. Rateledge and Kristenson - Basic Biotechnology. Oxford University Press., 2001
4. MR Adams and MO Moss - Food Microbiology. Tata McGraw Hill., 1995
5. Industrial Microbiology by Casida., 1997
6. Principles of fermentations technology by P.F. Stanbury and A. Whaker - Perganion Press., 1984

ELECTIVE SUBJECT (ES)

(Decided by Research Supervisor)

Paper - III

Semester – I | Credits : 6

Category : Elective Subject (ES) | Hours/week : 6

Objective : To expose the researcher to specialized areas suggested by the research supervisor. This paper is designed so that the student acquires basic knowledge in the field of specialization and also on the applied areas. This would enable the research scholars to plan experiments for their project work.

Proposed titles for the Paper III :

BT1151 - Plant Microbe interactions
BT1152 - Plant Genetic Engineering
BT1153 - Microbial Diversity
BT1154 - Plant Diversity
BT1155 - Envirnomental Biotechnology
BT1156 - Clinical Biochemistry
BT1157 - Medicinal plants.