DEPARTMENT OF PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

M.PHIL PLANT BIOLOGY AND BIOTECHNOLOGY

M.PHIL PROGRAMME

REVISED SYLLABUS

Loyola College (Autonomous)

Chennai- 600 034

DEPARTMENT OF PLANT BIOLOGY & BIOTECHNOLOGY

M.Phil. PLANT BIOLOGY AND BIOTECHNOLOGY RESTRUCTURING - SYLLABUS (2019)

Loyola College (Autonomous)
(College of Excellence by UGC)
(Reaccredited at A (3.70 CGPA) by NAAC)
Chennai - 600034

M.Phil.- Plant Biology and Biotechnology
19 Batch onwards

Sub:Code		Title of the Paper	Credit
MBT 1501	MC-1	Research Methodology	6
MBT 1502	MC-2	Advances in Plant Science	6
MBT 1601	ES-1	Microbial Diversity	6
MBT 1602	ES-2	Plant Microbe Interactions Plant Genetic Engineering	6
MBT 1603	ES-3	Environmental Biotechnology	6
MBT 1604	ES-4	Medicinal Plants	6
MBT 1605	ES-5	Plant Tissue Culture and Photochemistry	6
MBT 1606	ES-6	Plant Molecular Biology & Tissue Culture	6
MBT 1607	ES-7	Biology of Actinomycetes	6
MBT 2701		Dissertation and Viva-voce	18

MBT 1501 RESEARCH METHODOLOGY

SEMESTER: I CREDITS: 6
CATEGORY: MC

Objectives:

1. *To impart knowledge on the basics and methods in research writing*
2. *To gain a thorough knowledge on working prinicipleand applications of the different instruments used in biological research.*
3. *To gain awareness on basic biostatistical and bioinformatics tools*

Learning outcome:

The students will be able to

1. *Understand the methodology of research writing*
2. *Gain in-depth knowledge on various techniques in biological research*
3. *Carry out simple bioinformatics searches for research purpose*
4. *Use statistical packages to analyze scientific data.*
5. *Acquire skill to design methodology and to perform research on plant science.*

UNIT I- Microtechniques

Microscopy: principle and applications - Microtechniques – Smear and squash preparation, maceration, temporary and permanent mounting - Microtomy: Fixation, dehydration, stains and staining methods – single, double, triple staining (nuclear, cytoplasmic, organelles) – Extraction and isolation methods (proteins, nucleic acids, secondary metabolites from plants, animals and fungi) - solvent system Qualitative methods for identification of secondary metabolites

UNIT II- Spectroscopy

pH meter: Principle and instrumentation, Centrifugation: Principle, types of centrifugation, rotors, application. Sonication, Freeze drying (lyophilization)

Spectrophotometry: Instrumentation – ultraviolet and visible spectrophotometry (single and double beam), Nanodrop spectrophotometer, infrared spectroscopy (FTIR), NMR, XRD, Circular Dichroism – Atomic absorption and atomic emission spectroscopy – Fluorimetry : principle and applications – Mass Spectroscopy: principle and applications

UNIT III- Separation Techniques

Chromatography techniques : principles and application – paper, column, thin-layer – gel filtration – ion exchange - gas chromatography – High Performance Liquid chromatography – Electrophoresis – Principle & types – SDS & Native PAGE and Agarose – Gradient gel - Determination of Molecular Weight

UNIT IV- Data Analysis

Measures of Dispersion - Mean , median, mode - Measures of Central Tendency – Range, Mean Deviation, Standard Deviation – Correlation and Regression – Probability Distributions : normal, binomial and Poisson distribution – Population and methods of sampling – Analysis of variance – Chi square analysis – Basics of SPSS - DMMRT. Basic bioinformatics - DNA and Protein databases – Information retrieval from databases – PubMed - Alignment methods – Structure prediction - Protein modeling .

UNIT V- Research Writing

Research and Writing – Introduction to Research Methodology – Scientific method – Types of research studies : Qualitative and Quantitative – Research methods: Sampling methods – Designing research – categories and design of experiments – Data collection - Data Analysis

Essentials of Writing – Planning the thesis – Scientific writing : Scientific paper, assignment, thesis and dissertation – Preparing the title – Writing abstract and summary , review of literature materials and methods – Presenting the results: Tables, Graphs and diagrams – Discussion writing – Citing references – Impact factor and Plagiarism . Writing a research proposal, research report and research grant proposal

Reference Books:

1. Ramadass P and Wilson Aruni A 2014. Research and Writing – Across the Disciplines, MJP Publications.
2. Gurumani N 2006. Research Methodology: for Biological sciences, MJP Publishers.
3. Keith Wilson and John Walker 2018. Practical Biochemistry Principles and Techniques, Cambridge University Press, 8thEdn,.
4. Upadhayay and Upadhyay 2015. Biophysical Chemistry – Principles and Techniques, Himalaya Publishing House.
5. Pranav Kumar –2016. Fundamentals and Techniques of Biophysics and Molecular Biology, Pathfinder Publications.
6. Palanivelu P 2009. Analytical Biochemistry and Separation Techniques , Twenty first Century Publications.
7. SK Sawhney 1999. Introductory Practical Biochemistry, Narosa Publishing House.
8. Khan and Khanum 1994. Fundamentals of Biostatistics, Ukaaz Publications.
9. Ignacimuthu S 2013. Basic Bioinformatics, Narosa Publishing House.
10. Francis Ouellette BF and Andreas D Baxevanis 2011. Bioinformatics: A Practical Guide To The Analysis Of Genes And Proteins, 3rd Edition, Wiley Publishers.

MBT 1502 ADVANCES IN PLANT SCIENCE

SEMESTER: I CREDITS: 6
CATEGORY: MC

Objectives:

1. *To impart knowledge on the recent development in various branches of plant sciences.*
2. *To have an exposure on the working principles and applications of the different techniques used in plant research.*

Learning outcome:

The students will be able to

1. *Gain knowledge on biotechnological application of algae and fungi.*
2. *Understand the methodology of transgenic plant production.*
3. *Acquire skill to develop plantlet under in vitro condition.*
4. *Explain the process of bioremediation, factors associated and methods of bioremediation.*
5. *Gain in-depth knowledge on various techniques in plant sciences and apply them in their research.*

Unit- I: Algal and Fungal Biotechnology

A general account on the Economic Importance of Algae. Algal biofertilizers, Seaweed Liquid fertilizers, Pigments from Algae, Single cell Production from Algae. Large scale cultivation of algae using photo bioreactors.Biofuel from algae.
A general account on the Economic importance of Fungi.Mushrooms, their importance and cultivation.Fungi and antibiotic production.VAM Fungi and their importance.Fungi in enzyme production.Yeasts and their biotechnological importance.

Unit- II: Plant – Microbe interactions

Positive interactions: Legume-Rhizobium relationship, Casuarina-Frankia relationship
Biological nitrogen fixation and the role of nif genes. Development of biofertilizers.

Negative interactions: Plant pathogenesis, Mechanisms of pathogenesis; anatomical and biochemical changes due to pathogenesis; Case study of important viral, fungal and bacterial disease in plants.

Unit- III: Plant Tissue Culture

Tissue culture in crop improvement Callus culture, Pathways of Regeneration, Direct and Indirect Organogenesis and Somatic Embryogenesis, Somaclonal variations, Anther culture, Somatic hybridization.Artificial seed production, Secondary metabolites, production.Cryopreservation.

Unit- IV – Plant Genetic Engineering and Bioethics

Basic concepts and genetic engineering for increasing crop productivity. DNA modifying enzymes and vectors.Methods of recombinant DNA technology.Nucleic acid hybridization.Gene libraries.PCR amplification. Agrobacterium mediated plant gene transformation, Physical methods of gene transformation, Molecular markers and their applications. Barcoding.Applications of gene cloning in basic and applied research, Molecular breeding, Molecular taxonomy.Gene manipulation for increasing Photosynthesis, Nitrogen fixation, Nutrient uptake efficiency, Stress tolerance.Social and ethical issues in Biotechnology.Principles of bioethics, Ethical conflicts in biotechnology.

Unit- V: Plants in Energy and Bioremediation

Biomass as a source of energy, biomass conversion, biocomposting; vermiculture; organic farming. Environmental pollution - types of pollution, sources of pollution. Bioremediation: Principles and Mechanisms of Bioremediation; types of bioremediation - phycoremediation, mycoremediation and phytoremediation

BOOKS FOR REFERENCE

1. Grierson, D and Convey, S.N., 1988. Plant Molecular Biology Published in the USA by Chapman and Hall, New York.
2. Dubey, R.C.2014. Text Book of Biotechnology. S. Chand & Company Ltd., New Delhi.
3. Ignacimuthu, S.1997. Plant Biotechnology . Oxford Publishing Co. Pvt. Ltd., New Delhi.
4. Trivedi P.C. 2001. Algal Biotechnology.
5. Rashid, A. 2009. Molecular physiology and Biotechnology of Flowering plants. Narosa Publishing House Pvt. Ltd., New Delhi.
6. Gupta P. K. 2017. Elements of Biotechnology. Rastogi Publications. Meerut.
7. Ignacimuthu , S., 2003. Plant Biotechnology. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
8. Kalyan Kumar De., 2008. Plant Tissue Culture – New Central Book Agency (P) Ltd., Calcutta.
9. Mascarenhas A.F., 1991. Hand book of Plant Tissue Culture. Indian Council of Agricultural Research. New Delhi.
10. Primrose, S. B. and Twyman, R. M. 2006. Principles of Gene Manipulation and Genomics. 7th edition.Blackwell Publishing.
11. Caldentey, K.M.O. &Barz, W. H. 2002. Plant Biotechnology and Transgenic Plants. Marcel Dekker. Inc.
12. Doyle, A. and Griffiths, J. B., 1999. Cell and Tissue Culture: Laboratory procedures in Biotechnology.John Wiley & Sons Ltd.,

13.Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., and Walter, P., 2008. The Molecular Biology of the cell.5th edition. Garland Science Taylor and Francis Group.