

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI-600 008**  
**DEPARTMENT OF PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**CHOICE BASED CREDIT SYSTEM OUTCOME BASED EDUCATION**

**M.Phil. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**  
**(OFFERED FROM THE ACADEMIC YEAR 2018-2019)**

**PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)**

On obtaining a research degree the scholar will be able to:

PEO1 Demonstrate advanced domain knowledge competencies and display high order discerning and synthesizing capabilities to address local, regional and national concerns through innovative well researched solutions.

PEO2 Continue to serve the community of professionals and experts as both independent and team player with a strong grounding in ethics, inclusivity, gender parity and environmental sustainability.

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**PROGRAMME OUTCOMES (POs)**

PO1 – Acquire in depth knowledge in their area of specialization and integrate into the research culture of the department.

PO2 – Gain expertise and confidence in handling of all analytical tools, interpretation of spectra to characterize materials by using software and theoretical knowledge.

PO3 – Recognize and integrate life-long learning skills to become pro-active in personal and professional life.

PO4 –Pursue Ph.D programme in their field of research and enhance leadership and teaching skills.

PO5- Apply the scientific knowledge to develop innovative ideas, products and methods for the benefit of biosphere at large.

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**PROGRAMME SPECIFIC OUTCOME (PSO)**

After completion of the course the students will be enable to

1. Acquire contextual knowledge in the process of developing new products and gain expertise of well define area of research in Plant Biology and Plant Biotechnology.
2. Apply innovative methodologies to carry out independent research leading to pursue Ph.D programme and empower student's personal and professional development.
3. Analyse the impact of new emerging areas of Plant Biology and Plant Biotechnology in the industrial environmental and social contexts.
4. Employ the scientific skills and analyse data using appropriate statistical methods and tools to design and execute the research projects.
5. Promote leadership and teaching skills to evolve as excellent professionals in academic institutes and in public sector units-CSIR, DBT, DST, DRDO laboratories and to contribute towards the growth of the country.

## M.Phil PLANT BIOLOGY AND PLANT BIOTECHNOLOGY 2018-2019 ONWARDS

### COURSE PROFILE

CORE/ELECTIVE	TITLE OF THE PAPER	PAPER CODE
CORE 1	Research Methodology	10M18/REM
CORE 2	Advanced Plant Biotechnology	10M18/ADP
ELECTIVE 1	Genetics	10M18/GES
ELECTIVE 2	Herbal Botany	10M18/HEB
ELECTIVE 3	Plant Pathology	10M18/PLP
	Dissertation	10M18/DSN

The above courses of the M.Phil programme enrich the skill in Employability, skill development / Entrepreneurship which caters the needs of the students.

## M.PHIL- PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

### SEMESTER 1

#### CORE PAPER I- RESEARCH METHODOLOGY

COURSE CODE:10M18/REM

CREDIT-5

#### UNIT 1 **Microscopic technique:**

Light microscope – Principle, construction and application –Dark field, Phase contrast, Fluorescence microscope.Principle, construction, sample preparation and application of electron microscope – SEM, TEM. Cytophotometry – Flow Cytometry

#### UNIT II

#### **General Lab Technique:**

pH Buffering mechanism. Choice and preparation of common buffers – Potassium Phosphate buffer and Tris Acetate Buffer. pH measurements. Methods of sterilization of media and Glassware. Media – Choice of media, isolation, purification and maintenance of Algae, Fungi and Bacteria. Methods of Determining microbial number – Batch culture, continuous culture. Application of Fermenters.

### UNIT III

#### **Seperation Technique:**

##### **Centrifugation:**

Principle of sedimentation, Relative Centrifugal Force (G), Types and uses of Centrifuge – Bench top Centrifuge, Large capacity centrifuge, High Speed Refrigerated Centrifuge, Preparatory centrifuge and analytical centrifuge. Zonation and Isopycnic Centrifuge.

**Chromatography-** Principle, procedure, applications- TLC, Column chromatography, Ion exchange chromatography, HPLC, HPTLC, GC-MS.

**Electrophoresis-** General principle- factors affecting electrophoresis samples, principle, procedure and applications- Agarose gel, PAGE and SDS- PAGE.

### UNIT IV

#### **Immunotechnique:**

Properties and type of Antibody and Antigen. Application and Production of Monoclonal antibodies and Polyclonal antibodies. Immunodiffusion, Immunoelectrophoresis, Immunolabelling – Biotin. ELISA.

### UNIT V STATISTICAL METHODS:

Measurement of dispersion – range, variance, standard deviation, standard error. Test of significance based on large sample-small sample – Student t-test – ANOVA and DMRT. Probability – Probability distribution – Binomial, Poisson, and Normal. Simple correlation and Regression. Computer application - SPSS package, Scientific writing – Manuscript preparation, citation style. Types and characteristics – Designing the research work.

#### REFERENCE:

1. Principles of fermentation technology by Stanbury, P.F Whitaker A. and Hall 1995. Pergaman. Mc Neul and Harvey
2. Gurumani, N. (2005) Biostatistics, 2<sup>nd</sup> edn. MJP publications, India.

3. Milton, J.s. (1992) Statistical method in Biological and Health Sciences. McGraw Hill Inc., New York.
4. Spiegel, M.R. (1981) Theory and Problems of statistics, Schaum's Outline series McGraw-Hill International Book Co., Singapore.
5. Conn. E. E. and P. K. Stump. 1976.Outlines of Biochemistry Wiley Eastern
6. Robert Horton, H. L. A. Moran, R. S. Ochs, J. D. Rawn and K. G. Scrimgeour. 1996. 22. Principles of Biochemistry. Printice hall International. NJ.
7. Principles of Biochemistry by A.L.Lehninger, D.L.Nelson & M.M.Cox. (1993) Worth Publishers, New York.
8. Gurumani, N. (2006) Research Methodology for Biological Science, MJP publications, India
9. R.A.Day.How to write a scientific paper,Cambridge University Press.
10. Methodology of Scientific Research Programs Cambridge University Press.
11. Research Methodology,Stanford University.
12. Journal of Immunological Methods ,Elsevier Publication.
13. The Indian Journal of Statistics, Springer Publication.

## **M.PHIL- PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

### **SEMESTER 1**

#### **CORE PAPER II- ADVANCED PLANT BIOTECHNOLOGY**

**COURSE CODE:10M18/ADP**

**CREDITS -5**

#### **Unit I Microbial and Cell Fraction Technique:**

Cell and Tissue culture-Microbial culture, plant cell and tissue culture,cell sorting ,culture collection, cryopreservation. Cell fraction-Solid shearing, liquid shearing, high pressure extrusion, ultrasonic oscillation, use of proper osmoticum and antioxidants. French press. Isolation of mitochondria, chloroplast and nucleic acid.

#### **Unit II:**

#### **Phytochemical Techniques:**

Solvent Extraction- Maceration, Percolation, Cold Percolation, Steam distillation, Extraction of Essential Oils, Soxhlet Extractor.



Isolation of compounds – Quantitative estimation of the isolated compound- Characterisation and Identification.

### Unit III

#### Tools And Techniques:

Basic principle and biological applications - UV, FTIR, Mass spectroscopy and NMR.  
Nanoparticles – Green Synthesis- Characterization .

#### Unit IV Genetic Engineering:

Principles and Method-Southern Blotting,Northern Blotting,Western Blotting,Dot and Slot Blot.Enzymes used in genetic manipulation-Restriction endonucleases and Ligases. Gene transfer technique-Microinjection, biolistic gun, electroporation -principles and applications.

### Unit V

**rDNA technology:** Cloning vectors-Viral DNA, plasmid DNA, cosmids. Molecular marking system for microbes (Lac-Z and GUS), vectors of eukaryotes and their uses in transfer of DNA.DNA sequencing-Maxam and Gilbert method and Dideoxy method. Molecular probes, DNA fingerprinting, DNA microarray. Bioinformatics-sequence analysis and alignment, protein sequencing. Drug discovery-procedure and applications.

**Radiolabelling techniques**-Half life, types of radiation decay, measurement of radioactivity. Incorporation of radio isotopes in biological tissues and cells. Radio Immuno Assay . Safety guidelines.

### REFERENCE:

1. Lewin, B. 2000. Genes VII, Oxford University Press, USA.
2. DeRobertis, E.D.P. and De Robertis, E.M.F. 2001. Cell and Molecular Biology, Lippincott Williams & Wilkins, Bombay.
3. Plant cell, tissue and organ culture. Springer Lab Manual. Potrykus, I, and G. Spangenberg (eds.). 1995.
4. Gurumani, N. (2006) Research Methodology for Biological Science, MJP publications, India.
5. Gene transfer to plants. Springer Lab Manual. Jones, H. 1996. Plant gene transfer and expression protocols. Methods in molecular biology . 49. Humana Press. Kreuzer, H, and A. Massey. 1996.
6. Recombinant DNA and biotechnology. A guide for teachers. ASM Press,1996.
7. Westhead, D.R. J.H. Parish & R.M. Twyman. Bioinformatics, Viva Books,2010.
8. Phytochemical Analysis, N.Raaman, New India Publishing Agency, 2006.
9. Journal of Chromatography A, Selected Edition 2013,SCIE, SSCI,Thomson Reuters.
10. Journal of the American Society for Mass Spectrometry.
11. Essentials of Nanotechnology ,Jeremy Ramsden, Ventus Publishing,ISBN978-87-7681-418-2
12. Plant Biotechnology Journal ,Wiley Online Library
13. Journal of Advanced biotechnology and Bioengineering, Synergy Publication.

**M.Phil - DEPARTMENT OF PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**SEMISTER II**

**ELECTIVE - GENETICS**

**COURSE CODE: 10M18/GES**

**CREDITS:5**

**UNIT I**

**Cytogenetics:** Chromatin and organization of chromosomes. Relation between structure and function of chromatin. Karyotype, Idiogram, Banding methods – Q,G,C,R,N banding.HRT technique. Origin and significance of chromosomal aberrations. Physical, Chemical mutagens and chromosomal damage Structural chromosomal changes.

**Molecular Genetics:** Introduction – Evidences for DNA as genetic material – Mechanism of DNA replication – The topological problem. Molecular events in transcription- Inhibition of Transcription, Mechanism of Protein synthesis – Inhibition of protein synthesis. Extra Chromosomal protein synthesis.



## UNIT II:

**Prokaryotic Genetics:** Plasmids – Properties and Classification, conjunctive plasmids – Resistance factors - Significance of plasmids. Bacteriophage – properties, Phage mutants, Genetic maps, Phage life cycle, Molecular and enzymatic mechanism. Principles of genetic engineering and gene cloning.

## UNIT III:

**Eukaryotic Genetics:** Alleles – Ultra structure, allelic sites, complementation test, Multiple alleles. Multiple genes– Nature, Mechanism, Quantitative inheritance, Polygene concept. Developmental genetics - Mutation affecting early development, Birth defects due to abnormal Karyotyping - Sex differentiation, Developmental Sex abnormalities – hormones in Development.

## UNIT IV:

**Genes And Environment:** Introduction – Environmental toxicants – Chemical and physical mutagens, carcinogens, Teratogens and their relationship.

**Radiation Genetics:** Measurements of Radiation – its effect on cells. Cell kinetics and radiation response. Radiation pathology. Radiation alternations – Radiation protection – Clinical applications.

## UNIT V:

Molecular mechanism of physical and chemical mutagenesis. Repair system. Test system in screening mutagenesis. Application of mutagenesis in screening environmental toxicants. Plant alkaloids as chemical mutagens.

## REFERENCE:

1. Snustad Peter, D. Michael J. Simmons. Principles of Genetics, John Wiley Sons.
2. Robert H. Tamarin. Principles of Genetics, Tata McGraw Hill Company.
3. Benjamin Lewin . Genes VIII, Prentice Hall.
4. Primrose,*et al.*2005 .Principles of Gene Manupulation. Black Well Science, London.
5. Genome Biology And Evolution ,Selected Edition 2013,SCIE,SSCI,Thomson Reuters.
6. Molecular Biology by David Freifelder, Jones & Bartlett Publishers, 1986.
7. Journal of Genetics And Genomics, Elsevier Publication.
8. Molecular genetics and Genomics, Springer Publication.

9. Journal of Genetics and Plant Breeding, Indian Academy of Sciences publications.
10. Molecular Genetics and Metabolism, Elsevier Publication.

**M.Phil - DEPARTMENT OF PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**SEMISTER II**

**ELECTIVE –HERBAL BOTANY**

**COURSE CODE: 10M18/HEB**

**CREDITS:5**

**UNIT I:**

Introduction, impact of plant drugs in human welfare. Regional studies, Recent trends and Socio – economic aspects.

**UNIT II:**

Principles of collection, preparation/processing and storage of plant drugs. Methods of classification of plant drugs. Factors influencing the quality and variability of plant drugs such as geographical factors, climatic factors, soil and nutrients, genetic factors and biotechnology.

**UNIT III:**

Classification of plant drugs based on the source – Entire Plant, Root , Stem, Bark, Leaf, Flower, Fruit and Seed. Study of medicinal properties and uses with reference to the above.

#### **UNIT IV:**

Identification of Plant Drugs – Acid, Alcohol, Ester, Carbohydrates, Phenolic compounds, Volatile oils, Resins, Saponins, Flavonoids, Alkaloids, Vitamins, Hormones and Antibiotics - Extraction, Isolation and Characterization.

#### **UNIT V:**

Conservation of existing and endangered medicinal plants through various conservation strategies.

#### **REFERENCE:**

1. Pharmacognosy, C. K. Kokate, A. P. Purohit & S. B. Gokhale (1996), Nirali Prakashan, 4th Ed.
2. Natural Products in medicine: A Biosynthetic approach (1997), Wiley. Hornok, L. (ed.) (1992).
3. Cultivation & Processing of Medicinal Plants, Chichister, U. K: J. Wiley & Sons. Trease & Evans.
4. Pharmacognosy – William Charles Evans, 14th ed. (1989), Harcourt Brace & Company.
5. Medical Herbalism: The Science Principles and Practices of Herbal Medicine by David Hoffman, Healing Arts Press, 2003
6. Journal of Herbal Medicine, Elsevier Publication.
7. Journal of Natural Medicine, Springer Publication.
8. Journal of Botany And Plant Biology, Progress Academic Publishing House.

**M.Phil - DEPARTMENT OF PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**SEMISTER II**

**ELECTIVE – PLANT PATHOLOGY**

**COURSE CODE: 10M18/PLP**

**CREDITS:5**

**UNIT I:**

History and principle of plant pathogens. Study of plant infection, host –parasite interaction.

Role of enzymes and toxins in pathogenesis .Symptomatology and dissemination of pathogen.

**UNIT II:**

Pathological physiology of diseased plants – plant water relations, Photosynthesis, Respiration and Growth.

**UNIT III:**

Defense mechanism – Structural and Biochemical Genetics of plant diseases. Molecular basis of disease resistance. Molecular tools for detection of plant pathogens.

**UNIT IV:**

Plant diseases Epidemiology, Modern methods of Disease forecast. Epiphytotic –Causes and decline. Plant Protection – Cultural, Physical, Chemical, Biological,Genetical Breeding and Hybridization.Immunization.

#### UNIT V:

Common diseases of crop plants with special reference to South India. – Causal Organism, Symptoms and Disease management.

#### REFERENCE:

1. Agrios, G.N. Plant pathology, IV Edition, Academic prus 1998.
2. Bilgrami K.S. and Dube H.C., A Text Book of Modern Pathology Vikas publishing house pvt., Ltd., 1976.
3. Chatterjee P.B., Plant protection techniques Bharati Bhavan 1997
4. Das Gupta H.K. Principles of Plant pathology Allied Publishers 1988.
5. Mehrotra R.S. Plant Pathology Tata-Mc Graw Hill Publish, co., Ltd., 1980.
6. Rangaswami G and A. Mahadevan Diseases of Crop plants in India. IV Edition Practice Hall 1999.
7. Singh R.S. Plant Pathogens : The fungi Oxford & IBH Publisher Co.1982.
8. Singh R.S. Plant Diseases Oxford and IBH publishing co., 1983.
9. Walker J.C. Plant Pathology Tata Mc Graw Hill Publishers 1969.
10. Mishra, A., A. Bohra and A. Mishra. 2011. Plant Pathology-Disease and Management. AgroBios, Jodhpur.
11. Pathak, Khatri and Pathak. 1996. Fundamentals of Plant Pathology. AgroBios, Jodhpur.
12. Pandey, B.P. 1982. Plant Pathology – Pathogen and Plant disease. S.Chand & Company Pvt. Ltd, New Delhi.
13. J.G.Manners – Principles of Plant Pathology.
14. Wheeler - Plant Pathology , Tata Mc Graw Hill.
15. Butler E.J. and Jones.S.G – Plant Pathology, Mac Millan , 1949.
16. European Journal of Plant Pathology, Springer Publication.
17. Journal of Plant Pathology And Microbiology, OMCS Publication.
18. Archieves of Phytopathology And Plant Protection, Taylor & Francis Publication.
19. Molecular Plant Pathology, Willey Online Library.
20. Journal of General Plant Pathology, Springer Publication.