MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI – 12

DEPARTMENT PLANT SCIENCE

UNIVERSITY DEPARTMENT

M.Phil. Botany – (CBCS)

(For those who join the course from the Academic year 2016-2017 onwards)

Eligibility for Admission:

M.Sc.in Botany/Plant Biology and Biotechnology/Plant Sciences/Agricultural Science/Life Sciences

Course Structure

S.No.	Semester	Subject	Credits	Hours/ week	Maximum Marks			Passing Minimum	
					Int.	Ext.	Tot.	Ext.	Total
1	I	**Core -I (Theory):** Research Methodology and Biostatistics	8	8	25	75	100	38	50
2	I	**Core – I (Theory) :** Advances in Plant Science	8	8	25	75	100	38	50
3	I	**Elective –I (Theory):Research Area Paper** 1. Plant Conservation Biotechnology 2. Phytochemistry and Drug Discovery	8	8	25	75	100	38	50
4	II	**Project and Viva-voce**	16	-	25	75	100	38	50
Total			40	-	-	-	400	-	-

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Research Methodology and Biostatistics

Unit I Microscopic techniques

Microscopy-principles and applications. Properties of electromagnetic radiation- Light, Phase contrast and Fluorescent microscopy. Calibration and Microscopic Measurements. Electron Microscopy-Principles and applications of TEM and SEM- Preparation of materials for Electron Microscope.

Unit II Analytical Methods

Spectroscopic techniques- UV and Visible, Fluorescence, IR, NMR, AAS, AES and AFM. Electrochemical techniques- Principles- Measurement of pH and preparation of biological buffers, oxygen electrode, biosensors and biochips. Radioisotope techniques-radioactivity, atomic stability and radiation-radiation decay. Detection and measurement of radioactivity and applications of GM and Scintillation Counter-labelling of biological molecules and autoradiography.

Unit III Separation techniques

Chromatography- Principles and applications-Paper, Thin layer, Column, GC, GLC, HPLC, MS. Centrifugation-Principles and types-preparative and general purpose centrifuges-ultracentrifugation-types-analytical ultracentrifuges.

Electrophoretic techniques-Principles and construction of horizontal and vertical electrophoresis-Buffers and electrolytic separation- detection by staining and estimation of electrophorograms by transilluminator and gel doc.

Molecular techniques: PCR based-RFLP, RAPD, AFLP, SSR, blotting techniques.

Unit IV Statistical Methods

Population and sampling, data collection, analysis and graphical representation. Measures of Central Tendency, Measures of Dispersion-Standard Deviation, Correlation and Regression analysis, Probability -normal and binomial distribution. Statistical testing: F-test, t-test and chi-square test. Experimental design, ANOVA one way and two way analysis, statistical softwares-MS Excel and SPSS.

Unit V Documentation of Research

Research- Meaning - Role of a researcher – Hypothesis - Methods-Approaches Objectives. Literature and Reference collection. Role of libraries in research, virtual libraries. Internet-Worldwide web-searching and browsing tools- e-journals and e-books. Manuscript preparation-Citation and Proof correction, Dissertation- components of a dissertation-tables, figures, footnote, discussion. Role of Supervisors/Guides in research.

Reference Books:

1. Bryan C Williams and Keith Wilson 1983, A biologist's guide to practical techniques of Practical Biochemistry Second edition. Edward Arnold Publications.
2. David Plummer, 1988. An Introduction to Practical Biochemistry, Tata McGraw Hill Publishing Company, New Delhi.
3. Ed Metcalfe; Atomic Absorption and Emission Spectroscopy, John Wiley and Sons.
4. George Casella and Roger L. Berger, 2003. Statistical Inference II Ed. Duxbury Advanced Series, Thomson Press.
5. Introduction to Gene cloning – Maniatis, Sambrook.
6. Introduction to practical molecular Biology – Philippa D. Dabre
7. Jayaraman, J,1985. Laboratory Manual in Biochemistry, Wiley Eastern Ltd.
8. Johansen, M., 1940. Plant Microtechnique, McGraw Hill Publishing Company, New Delhi.
9. Keith Wilson and John Walker., 2000. Practical biochemistry V Edition Cambridge Universities Press, London.
10. Khan and Khan. 1994. Biostatistics. Vikas Publising House Pvt. Ltd. New Delhi.
11. PCR Technology – Ehrlich.
12. Plant Biotechnology – Manual – Roberts.
13. Practical Biochemistry – Wilson and Walker.
14. Research techniques in biological sciences I Ed. G.S.Sandhu. Anmol publications, New Delhi. 1990.
15. Stock, R and Rice, C.B. F., 1980. Chromatographic methods, Chapman and Hall Ltd. London.
16. Panse and Sukhatme. 1992. Statistical Methods for Agricultural workers. ICAR, New Delhi.
17. Steel and Torrie, 1986. Principles and Procedures of Statistics with special reference to Biological Sciences.
18. Berg, B. L., Lune, H., 2004. Qualitative research methods for the social sciences, Pearson Boston.
19. Kothari, C.R., 2004. Research Methodology Methods and Techniques, New Age International
20. Merriam, S. B., 1998. Qualitative Research and Case Study Applications in Education. Revised and Expanded from" Case Study Research in Education.", Jossey-Bass Publishers, Sansome St, San Francisco, CA.
21. Bogdan, R.C., Biklen, S. K., 1998. Qualitative research in education. An introduction to theory and methods, Allyn & Bacon, A Viacom Company, MA 02194.

22. Davis, M., 1997. Scientific Papers and Presentations‖ San Diego: Academic Press.
23. Isaac, S., Michael, W., 1971.Handbook in research and evaluation, (2nd ed.), San Diego, USA
24. McDonald, J. H., 2009. Handbook of biological statistics, Vol. 2, Baltimore, Sparky House Publishing. MD, USA.
25. Gomez, K.A., Gomez, A.A., 1984. Statistical procedures for agricultural research, John Wiley & Sons.
26. Townend, J., 2012. Practical statistics for environmental and biological scientists, John Wiley & Sons.

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Advances in Plant Science

Climate change and plant diversity: Biodiversity – Alpha, Beta, Gamma; Species, genetic and ecosystems diversity. Centres of origins of crops – Vaviolv's Theory, Megabiodiversity, centres of origins of genetic diversity, Plant Genetic Resources (IBPGR/ NBPGR). Endangered plants – IUCN categories, Red Data Books, *In Situ* and *Ex situ* conservation strategies. Components of the atmosphere, greenhouse gases & green house effect, global warming and climate change, sea level rise, increased CO_2 levels, impacts on plants. Carbon sequestration, carbon credits and economy and energy policy. Climate Change adaptation and mitigation strategies (UNEP/ FAO/ IPCC / GBIF / CBD).

Plant Physiology: Photosynthesis recent concepts in Photosystems I & II, ATP complex. Chloroplast DNA. Water transport and utilization. Resource mobilization and allocation. Advances in auxin and cytokinin molecular synthesis and function. Biochemistry of plant animal interaction.

Plant Energy: The concept of energy richness in plants – lignocellulose, sugars and terpenoids. Plants that produce fuel, wood, waxes, alcohol and hydrocarbons. Products include biodegradable plastics, industrial enzymes, industrial oils, biofuels, fibers, papers, agents for bioremediation, phytoremediation.

Molecular biology. Cloning vectors and Transgenics. Genetic improvement of medicinal plants through Bio-technology and Genetic engineering. Molecular diversity analysis using various types of markers. Applications of molecular techniques in herbal research. Applications of *in-vitro* culture methods in drug production. Growing and harvesting genetically engineered crops to produce compounds of industrial importance.

Advances in Plant Medicines: Plants as bioreactors, molecular pharming - production of pharmaceutically valuable compounds from plants. Plant made pharmaceuticals (PMP). Plantibodies Edible Vaccines / Plantigens, Interferons, Blood clotting factors, Anticoagulant, Hormones, Enzymes, Secondary metabolites, other proteins. IPR and medicinal plants.

Suggested Readings

1) Melchias, G. 2001. Biodiversity and Conservation. Science Publishers,NH USA
2) Krishnamurthy K.V. 2004. Advanced Textbook on Biodiversity: Principles and Practice. Oxford & IBH, New Delhi.
3) The World Conservation Strategy. IUCN, Switzerland.
4) Heywood, VH (Ed.). 1995. Global Biodiversity Assessment Report .UNEP.
5) Bidwell. R. G. S. 1979 Plant Physiology. Macmillon Delhi.
6) Lea, P. J. and R. C. Leegood. 1993. Plant Biochemistry and Molecular Biology, JohnWiley & Sons. New York.
7) Hans-walter heldt. 1997. Plant biochemistry and molecular biology. Oxford university press, New York. USA.
8) Datta. S. C. 1989.Plant Physiology. Central Book Depot. Allahabad. 48
9) Gauch. H. G.1972. Inorganic Plant Nutrition. Hutchinson & Dowd, New York.
10) Govindji. 1982. Photosynthesis. Academic Press, New York.
11) Hall. D. V. K. K. Rao. Photosynthesis. Arnold, London .
12) Jacob, WP. 1979. Plant Hormones and Plant Development. Cambridge University Press. Cambridge.
13) Jogdand. S.N.1997. Environmental Biotechnology – Industrial Pollution Management. Himalaya Publishing House.
14) Joseph Priest .2008. Energy: Principles, Problems, Alternatives, 6th Ed., Kendall/ Hunt Pub Co.
15) Singh, B.D. 2003. Plant Biotechnology. Kayani Publishers, New Delhi.
16) Waston, J.D., M. Gilman, J.Witkowski and M.Zoller. 1990. Recombinant DNA, 2nd Edition. New York: Scientific American Books.
17) Watson, J.D. and W.A. Benjamin. 2004. 3nd Edition. Molecular Biology of the Genes. Benjamin Cummings.
18) Freifelder, D. 1983. Molecular Biology. 2nd Ed. Narosa publishing house.
19) Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology, W.H. Freeman and Co., New York, USA.
20) Wolfer, S.L. 1993 Molecular and Cellular Biology, Wadsworth Publishing, USA.
21) Nicholl, D.S.T. 1994. Introduction to Genetic Engineering. Cambridge University Press, London.
22) Revised guidelines for research in Transgenic plants (August 1998), Department of Biotechnology, Ministry of Science & Technology, Government of India, New Delhi.

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1. Plant Conservation Biotechnology

Unit –1

Introduction - Need for inventorying and documentation. Principles of conservation; extinctions; environmental distribution status of plants based on international union for conservation of nature (IUCN). Red data list of Indian plants.

Unit – 2

Plant conservation Biotechnology – Integration of biotechnology into conservation practices. Molecular approaches to assessing plant diversity. Biotechnology in plant germplasm acquisition. Methods of Plant conservation, and sustainable utilization of plant genetic resources.

Unit – 3

Tissue culture techniques for ***In vitro*** Plant Conservation: Culture room and lab facilities. Media composition and preparation – plant growth regulators, adjuvants; sterilization. Morphogenetic patterns. Callus culture - Subculture, differentiation, and regeneration. Organogenesis : Embryoids, Caulogenesis, Rhizogenesis, Cell Line, Somaclone, Gametoclone.

Unit - 4

Micro propagation – Preparative stage: Germplasm acquisition and selection of explants. Establishment stage: Axenic and viable cultures. Multiplication stage. Plantlet production: induction of roots and acclimatization of plantlets to green house condition. Somatic embryogenesis. Synthetic seed technology. Suspension culture, in vitro production of secondary metabolites, cell immobilization.

Unit – 5

Cryopreservation and germplasm storage: Slow or retarded growth. Principles, Cryoprotection, Freezing and long term cryogenic storage, protocols and recovery of germplasm. Conservation of Rare, endemic, threatened and economically important plants of India, current status and Active research stations in India. Stability assessments of conserved plant germplasm.

References

1. Dodds.I.H, and Roberts.L.W, 1995, Experiments in plant tissue culture. Cambridge University press, London.
2. Erica E.Benson. 1999, Plant conservation Biotechnology. Taylor and Francis Ltd., UK.
3. Dixon.R.A, 1994, Plant cell culture, A Practical approach.IRL press.Oxford, London.
4. Freifelder.D.1990.Molecular Biology.Narosa publishing house, New Delhi.
5. Murray Moo – Young. Plant biotechnology, comprehensive biotechnology series, pergamon press, Netherlands.
6. Narayanasamy.S, 1994, Plant cell and tissue culture. Tata McGraw – Hill Publishing co., Delhi.
7. Yeomen, 1987, Plant cell culture technology. Narosa Publication. New Delhi.
8. Lindsay, 1992, Plant Tissue Culture manual, Kluver Academic Publishers. Netherland.
9. George. E. F, 1994, Plant Propagation by Tissue culture. Exegectics Ltd., England.
10. Vasil.I.L, and Vasil.V.K, 1992, Plant Biotechnology and tissue culture. Kluver Academic Publishers, Netherlands.
11. Raven, Johnson, Losos, Mason and Singer 2008. BIOLOGY. 8th edition. McGraw Hill. New York, New Delhi.
12. Russell, Wolfe, Hertz and Starr 2008. Biology – THE DYNAMIC SCIENCE. Thomson Brooks/Cole, Australia, United States.

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2. Phytochemistry and Drug Discovery

Unit I : Plant Therapeutics-Definition-Aim and scope-History-Importance, Classification of crude drugs - morphological, taxonomical, therapeutic, and chemical. Collection and processing of crude drugs-drug evaluation-anatomical physico-chemical and chemical screening - WHO guidelines - standardizations of drugs - drug adulteration.

Unit II : Medicinal plant wealth of India. Conservation of medicinal plants *in-situ* and *ex-situ.* Present status and future prospects of medicinal crops. Export and import of medicinal plants by India, prospects and constraints of medicinal plant based industries.

Unit III : Secondary metabolites- definition, classification-alkaloids, terpenoids, glycosides, resins and volatile oils- properties - qualitative and quantitative analysis- role in pharmacology. Natural dyes-extraction of Indigo - uses.

Unit IV: Phytopharmaceuticals-Drugs of plant origin-drugs of mineral origin-maerine drugs-antibacterial and anti viral drugs. Extraction, purification and structural elucidation of phytopharmaceuticals- infusion, Decoction, digestion maceration, percolation, successive extraction, supercritical fluid extraction, steam distillation, hyphenated techniques.

Unit V: Extraction procedures for active principles-Withaonalides, Hyoscyamine and Vinblastine. Extraction methods of essential oils. **Recent trends in plant medicines. Types of new drugs, mode of action, chemical structure based elucidation of drug discovery.**

Reference Books

1. Kokate, C.K. Purohit, A.P. and S.R. Gokhale (2004) Pharmacognosy, Nirali Prakashan Publications, Pune
2. Evans, W.C. Pharmacognosy 1987 Harcourt Brace &Company Asia Pvt.Ltd.,
3. Faroogi, A.A and Sreeramu, B.S.2001 Cultivation of Medicinal and Aromatic Crops, Universities press.
4. Agarwal, S.S and M. Paridhavi. 2007 Crude Drug Technology. Universities Press, Hyderabad
5. Gurdeep Chatwal 1983. Organic Chemistry of Natural Products. Himalaya Publishing house, Mumbai.
6. Tewari, K.S., Vishnoi, N.K., Mehrotra, S.N 1998 Text book Of Organic Chemistry. Vikas Publishing House Ltd.,
7. Anonymous, 1948-1976.The Wealth of India 11 Vols.
8. Bhattacharjee,S. K.2004. Handbook on medicinal plants, Pointer publishers. Jaipur
9. Horticulture college, TNAU, 2002. Handbook on Cultivation of medicinal plants. TNAU Publishers.
10. Joshi, S.G 2000. Medicinal plants, Oxford and IBH Company Private Ltd. New Delhi.
11. Sharma, P. 2000. Database on medicinal plants used in Ayurveda. Ministry of health and family welfare.
12. Srivastava, A.K.2006 Medicinal plants, International Book Publishers, Dehradun.
13. Yoganarasimhan, S.N.2000. Medicinal plants of India, Vol2. Tamilnadu, Interline Publishing Private Ltd. Bangalore, Dehradun and Michigan.

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