SYLLABUS

MANONMANIAM SUNDARANAR UNIVERISTY, TIRUNELVELI-12

PG - COURSES – AFFILIATED COLLEGES

Course Structure for

M.Sc. Botany

(Choice Based Credit System) (with effect from the academic year 2021- 2022 onwards)

Semester-II				
Part	Subject Status	Subject Title	Subject Code	Credit
III	Core-7	Pteridophytes, Gymnosperms and Paleobotany		4
	Core-8	Genetics and Cell Biology		4
	Core-9	Plant Anatomy, Embryology and Morphogenesis		4
	Core-10	Entrepreneurship and Economic Botany		4
	Core - 11	Field Work		3
	Core-12 Practical - 3	Pteridophytes, Gymnosperms, Paleobotany, Plant Anatomy, Embryology and Morphogenes		2
	Core-13 Practical - 4	Genetics, Cell Biology, Entrepreneurship and Economic Botany		2

PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY

Prerequisite:

Basic knowledge on pteridophytes and gymnosperms from Undergraduate programme

Objectives:

- To learn about classification of pteridophytes and gymnosperms
- To learn about interrelationships and economic importance of pteridophytes and gymnosperms
- To understand the concept of Paleobotany

Outcome:

- Acquisition of knowledge about pteridophytes and gymnosperms
- Graduates will have a solid ideas about paleobotany
- Provide knowledge of lower group to higher group habits



UNIT – I

General features, origin and economic importance of Pteridophytes. Classification of Pteridophytes (Smith (1955) and K.R.Sporne).

Range of morphology, structure, reproduction and evolution of gametophytes and sporophytes of the following : Rhynia, Lepidodendron, Calamites.

$\mathbf{UNIT} - \mathbf{II}$

Morphology, structure, reproduction and evolution of gametophytes and sporophytes of the following: Angiopteris, Selaginella, Isoetes, Equisetum, Ophioglossum, Pteris, Salvinia and Azolla.

UNIT – III

Stelar evolution in Pteridophytes. Telome theory – concept, significance, merits and demerits. Life cycle patterns. Apomictic life cycle. Economic importance of Pteridophytes.

$\mathbf{UNIT} - \mathbf{IV}$

General features, origin and economic importance of Gymnosperms. Classification of Gymnosperms (Sporne 1965). Resemblances and differences between Gymnosperms and Pteridophytes. General account of Williamsonia

Distribution morphology, anatomy, reproduction and phylogeny of the following : Cycas, Araucaria, Ginkgo, Taxus, Ephedra and Gnetum

$\mathbf{UNIT} - \mathbf{V}$

Concepts of Paleobotany. A general account on Geological Time Scale. Fossil types – compressions, incrustation, casts, molds, Pterifications, coal balls, compactions and pseudofossils. Systematic and Nomenclature of fossil plants.

Practicals

Pteridophytes : Selaginella, Isoetes, Pteris, Salvinia and Azolla.

Fossil slides :

Rhynia, Lepidodendron, Calamites.

Gymnosperms :

Cycas, Araucaria, Ginkgo, Taxus, Ephedra.

Fossil slides :

Lyginopteris, Heterangium, Cordaites and Medullosa.

To maintain a record note book for evaluation

Reference Books

- 1. Arnold, C.A. 1947. An introduction to Paleobotany M C Graw Hill Book co.
- 2. Chamberlain, C.J. 1957. Gymnosperms structure and Evolution. University Chicago Press, New York.
- 3. Nikias, K.J. 1981. Palaeobotany, Palaeoecology and Evolution. Praeger Publishers, U.S.A.
- 4. Parihar, N.S. 1985. The Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
- 5. Rashid, A. 1986. An Introduction to Pteridophyta. Vani Educational Books New

Nesamony Memorial Christian College, Marthandam

Delhi.

- 6. Seward, A.C. 1919. Fossil Plants vol. I, II, III and IV. Cambridge University Press, London.
- 7. Smith, G.M. 1971. Cryptogamic Botany vol. II. Bryophytes and Pteridophytes. Tata Mc Graw Hill, New Delhi.
- 8. Sporne, K.R.1972. The Morphology of Pteridophytes B.I. Publications, Madras.
- 9. Sporne, K.R.1974. The Morphology of Gymnosperms. B.I. Publications, New Delhi.
- 10. Sundararajan, S. 2007. Introduction to Pteridophytes. New Age International Publishers; New Delhi.
- 11. Vashishta,P.C et al; 2006. Botany for Degree Students. Gymnosperms. S.Chand and Co; Ltd., New Delhi.
- 12. Singh NP and R C Srivastava 2013 The Gymnosperms of India: A checklist, by Botanical Survey of India.
- 13. Sharma, O.P. 2017. Pteridophyta. Macmillan India Ltd., India.
- 14. AVSS Sambamurty 2020 A text book of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany. Dreamtech Press, distributed by Wiley

- 1. https://www.youtube.com/watch?v=zl6Xw9aGu-s
- 2. https://www.youtube.com/watch?v=avK7hGnaRAY
- 3. https://www.youtube.com/watch?v=30dxEVDtZ20
- 4. https://www.youtube.com/watch?v=sC9iqGb94hc
- 5. 5. https://www.youtube.com/watch?v=2N2Ethc-Pw8



GENETICS AND CELL BIOLOGY

Prerequisite:

Basic knowledge in Genetics and Cell biology gained from Undergraduate programme

Objectives:

- To learn about the totipotency of cells
- To understand the synthesis of DNA and RNA
- Role of genetics and cell biology in plant diversity

Outcome:

- Graduates will understand the concept of genetics and cell biology
- Acquisition of knowledge about sex determination in plants
- wide ideas regarding cell biology

UNIT – I

DNA - structure and types (A, B, C & Z), Watson and Crick model of DNA, viral DNA, bacterial DNA, Mitochondrial and Chloroplast DNA. Repetitive DNA and interspersed repeated DNA.

Dissociation and re-association kinetics of DNA, cot value, rot value and its significance. The central dogma. DNA synthesis and replication (prokaryote and eukaryote).

UNIT – II

Damage and DNA repair mechanism – photo reactivation – excision repair - mismatch repair. Genetic recombination, Lysogenic and lytic cycle - Bacterial Transformation - Transduction and Conjugation.

Sex determination in plants - theories of sex determination. Sex linked, Sexinfluenced and sex limited characters. Gene mutation, physical and chemical mutagens and their mode of action.

UNIT – III

RNA-synthesis - types. RNA polymerases - role. Transcription - (Prokaryote, Eukaryotes), Initiation, elongation, termination, post transcriptional changes in RNA. Genetic code, Wobble hypothesis. Translation - ribosome assembly, formation of initiation complex, initiation factors, elongation and termination, translational inhibitors.

$\mathbf{UNIT} - \mathbf{IV}$

One gene one enzyme hypothesis. Fine structure of the gene, pseudogenes, noncoding genes, overlapping genes, split genes and pseudoalleles. IS Element-transposons and controlling elements.

Operon concept, trp operon, gal operon. Positive and negative control - Catabolite Repression, Gene Regulation in Eukaryotes. Gene silencing.

UNIT – V

Cell structure, cell theory- prokaryotic and eukaryotic, cell cycle, Cell divisions: Mitosis, Meiosis, cell communication and cell adhesion.



Ultra structure of chromosomes, Chromosome proteins –protamines, histones. Supernaturary and Megachromosomes, specialized types – polytene and lampbrush.

Practicals

Solving problems involving:

- 1. Simple Molecular biology problems based on the theory syllabus.
- 2. Interactions of genes.
- 3. Chromosome mapping from test cross data.
- 4. Sex determination, Sex linked inheritance.
- 5. Identification of different stages of meiosis from suitable plant material.
- 6. Interpretation of micrographs.
- 7. Study of mitotic index from suitable plant material

Spotters

Types of DNA, Cot curve, DNA melting curve, Karyotype and idiographic analysis.

Reference Books

- 1. Benjamin Lewin, 2004. Genes VIII. Pearson Prentice Hall.
- 2. Channarayappa, 2006. Molecular Biology. Principles and Practices. Universities Press (India), Pvt. Ltd., Hyderabad.
- 3. Gupta, R.K. 2006. Genetics. Rastogi Publications.
- 4. Nicholl, DST, 2001. An Introduction to Genetic Engineering. Cambridge University Press.
- 5. Old, R.N. and Primrose, S.B. 2004. Principle of Gene Manipulation. Blackwell Scientific Publication, USA.
- 6. Power, C.B. 2007. Genetics Vols I & II. Himalaya Publishing House. Kundanlal Chandak. Industrial Estate. Ghat Road. Nagpur.
- 7. Satyanarayana, U. 2006. Biotechnology. Books and Allied (p). Ltd. Kolkatha.
- 8. Russel, P.J. 2010. iGenetics. Benjamin Cummings, Sanfransisco Boston NewYork.
- 9. Turner, P., A. McLennan, A. Bates, M.White, 2005. Instant notes Molecular Biology, Third Edition, Taylor & Francis.
- 10. Avinash Upadhyay and Kakoli Upadhyay, 2005. Fundamentals of Molecular Biology. First edition, Himalaya Publishing House.
- 11. Sandhya Mitra 1994. Genetics. Tata McGraw-Hill Publishing Company Limited.
- 12. Ajoy Paul 2012. Text book of Genetics. Books and Applied (P) Ltd.
- 13. Strickberger. 2015. Genetics, Thrid edition, Pearson Education India
- 14. Siddhartha Mukherjee, 2017. The Gene: An ultimate history, Penguin Random House India
- 15. Verma, P.S. and V K Agarwal 2016 Cell biology, S Chand Publishing
- 16. Mark Harper, 2018 Plant Cell biology, Larsen and Kellar Education.

- 1. https://www.youtube.com/watch?v=TNKWgcFPHqw
- 2. https://www.youtube.com/watch?v=2_-jSoSaaTA
- 3. https://www.youtube.com/watch?v=mCOMD291oBM
- 4. https://www.youtube.com/watch?v=fOl7lrNuOnk
- 5. https://www.youtube.com/watch?v=39HTpUG1MwQ
- 6. https://www.youtube.com/watch?v=DwAFZb8juMQ
- 7. https://www.youtube.com/watch?v=jjEcHra3484



PLANT ANATOMY, EMBRYOLOGY AND MORPHOGENESIS

Prerequisite:

Basic knowledge in plant anatomy and embryology gained from Undergraduate programme

Objectives:

- To learn about the plant anatomical aspects
- To know the specialization of vascular tissues
- To understand the role of embryology and morphogenesis in plants

Outcome:

- Students get ideas about plant anatomy in detail
- Acquisition of knowledge about embryology
- Gain ideas and concepts in morphogenesis involved in plants

UNIT – I

Meristem – classification of meristems – Apical meristem. Organization of Shoot Apical Meristem (SAM) and Root Apical Meristem (RAM). Vascular cambium – origin, structure, seasonal activity.

UNIT – II

Xylem, Phloem and their elements – primary and secondary structures. Phylogenetic trends and specialization of xylem and phloem. Secondary growth – Periderm – structure, development of lenticels. Anomalous secondary growth.

UNIT – III

Wood anatomy – physical, chemical and mechanical properties. Defects in wood – natural defects, knots and defects due to diseases. Reaction wood – Tension and compression wood – Durability of wood. Ontogeny of dicot and monocot leaves. Kranz anatomy. Development of stomata, trichome development and Dendrochronology.

$\mathbf{UNIT} - \mathbf{IV}$

Microsporogenesis – Pollen Morphology, Pollen wall, Pollen development, Pollen dimorphism, pollen storage, Pollen allergy. Megasporogenesis - Different types of embryosac development, Fertilization, Endosperm – types and Haustoria organogenesis of dicot and monocot embryo. Apomixis and Polyembryony.

$\mathbf{UNIT} - \mathbf{V}$

Plant morphogenesis – definition – polarity – as expressed in external and internal structures and in isolated cells. Symmetry – types. Differentiation as expressed in structure - effect of environment on differentiation – factors controlling morphogenesis.

Practicals

- 1. Anomalous activity of Cambium in Boerhaavia, Achyranthus and Dracaena.
- 2. Wood anatomy any 4 common timbers (T.S, T.L.S and R.L.S)



- 3. Leaf anatomy C3 (rice) C4 (Cynodon).
- 4. Dissection of globular/cordate embryo from suitable seed.
- 5. Any photographs/pictures of Plant Morphogenesis.

Reference Books

- 1. Agarwal, S.B. 1990, Embryology of Angiosperms, a fundamental approach, Sahitya Bhawan, Agra.
- 2. Bard, J. 1990. Morphogenesis. Cambridge University Press, London.
- 3. Bhojwani, S.S and Bhatnagar, S.P. 1981. Embryology of Angiosperms. Vikas Publishing House Pvt Ltd, New Delhi.
- 4. Bonner, J.T. 1965 Morphogenesis. Oxford & IBH Publications, Bombay.
- 5. Brown et al, 1981. Text Book of Wood Technology Mc Graw Hill.
- 6. Bryant, J.A and Francis, D, 1985. The cell Division cycle in Plants, Cambridge University Press London.
- 7. Cutter, E.G.1978. Plant Anatomy, Edward Arnold Publishers Ltd; London.
- 8. Dwivedi, J.N, 1998. Embryology of Angiosperms; Rastogi Publications, Meerut.
- 9. Fahn, A. 1989. Plant Anatomy. MaxWell Pvt.Ltd; Singapore.
- 10. Mageswari, P, 1965. An Introduction to Embryology of Angiosperms. International society of plant Morphologies, University of Delhi.
- 11. Pijush Roy, 2006 Plant Anatomy; New Central Book Agency (P) Ltd Kolkata.
- 12. Singh, V; Pande, P.C and Jain, D.K 1987 Anatomy of seed plants. Rastogi Publications Meerut.
- 13. Singh, V, Pande, P.C, Jain, D.K.2015 Plant Anatomy, Embryology of Angiosperms, Morphology and Morphogenesis; Rastogi Publications Meerut.
- 14. Tayal, M.S.2016 Plant Anatomy; Rastogi Publications, Meerut.
- 15. Pandey S N and Chadha A 2009 Plant Anatomy and Embryology, Vikas Publishing House Pvt Ltd.
- 16. Richard Crang, Sheila Lynos-Sobaski, Robert Wise 2018. Plant Anatomy a concept based approach to the structure of seed plants, Springer
- 17. Sharma H P 2009 Plant Embryology classical and experimental, Alpha science International

- 1. https://www.youtube.com/watch?v=lLnjo4Pf2JM
- 2. https://www.youtube.com/watch?v=BrkfpPQAxJE
- 3. https://www.youtube.com/watch?v=XoPMy9rPhMo
- 4. https://www.youtube.com/watch?v=uSO6Jbg8Vd8
- 5. https://www.youtube.com/watch?v=_T1alaxhe7c



ENTREPRENEURSHIP AND ECONOMIC BOTANY

Prerequisite:

Skill based knowledge gained from Undergraduate programme

Objectives:

- To learn about role of entrepreneurship in human life
- To understand the role and economic importance of plants
- To provide the skills of various practices involved in entrepreneurship botany

Outcome:

- Graduates will understand the value of economically important plants
- Acquisition of knowledge in various skills to help become entrepreneur
- Wide knowledge about cultivation practices in business level

UNIT - I

Gardening: History, scope and importance of gardening - Types of Gardening: Water garden (Aqua Garden), Desert and Rock Garden (Xeric Garden), Kitchen Garden, Landscape Garden. Cultivation: Topiary, Bonsai, Nursery practices, Management and Marketing of garden plants.

UNIT - II

Olericulture : Vegetable Production, Processing and Trade in India. Major Vegetables of Tamilnadu- Onion, Cucumber, Tomato and Brinjal.

Floriculture: Aromatic flowers. Indoor cultivation of Flowers. Green, Poly and Glass Houses. Outdoor cultivation of Flowering Plants - Rosa and Chrysanthemum. Industrial uses of Flowers - Dyes preparation from flowers. Marketing Avenues.

UNIT - III

Mushroom Cultivation: Brief History - Scope of Mushroom Cultivation of Paddy straw and Oyster mushroom - Medicinal and Nutritional value of mushrooms. Pathology of Mushrooms. Harvesting and Post harvesting technology - Marketing, Packing, Storage and recipes.

$\mathbf{UNIT} - \mathbf{IV}$

Organic Farming: Historical Account of Organic Farming - Impact of organic farming in the current scenario. Bio Composting - Azolla Cultivation. Vermicomposting - methods – Vermiwash, Vermi Marketing.

Entrepreneurship - funding agencies (NABARD), Rural Banking, FAO, TNAU - STEP (Science & Technology Entrepreneurship Programme) - Govt and NGO's, Yojana Schemes. Entrepreneurship Development Programme (EDP). Need and their significance.

UNIT – V

Economic Botany - Utilization of selected crop plants - Cereals- (Rice, Millets- Ragi); Spices and Condiments - (Cardamom, Pepper); Commercial crops - Fibre (Jute); Timbers (Teak, Red Sander); Resins and Gums (Asaefoetida, Gum Arabic); Fixed oils (Gingelly,



Sunflower); Volatile oils - (Rosemary); Beverages (Tea, Coffee); Natural dyes (Indigo, Henna) and Drug yielding plants (Nilavembu and Ginseng).

Reference Books

- 1. Don Ellison, 2002. Garden Plants of the world. New Holland Publishers. V.K.
- 2. Valerie Bradley, 2006. The complete guide to House Plants. Readers Digest, New York.
- 3. Geoff Hamilton, 1993. Gardens of World Practical Gardening Course, BCA London.
- 4. Collin Levis 1997. Bonsai A Care Manual. Chancellor Press London.
- 5. Anna Pavord, 1996. The New Kitchen Garden. Dorling Kindersley London.
- 6. Jane Fearnley 1995. Gardening Made Fast, Wedenfeld London.
- 7. Vijaya Ramesh, K. 2007. Food Microbiology, MJP Publisher, Chennai.
- 8. Sumathi R. Mudambi, Shalini Roa, M.V. Raja Gopal, 2006. Food Science New Age International (P) Ltd., New Delhi.
- 9. N.K. Jain 2011. Fundamentals of Food Science Technology Processing and Preservation. Cyber Tech Publications.
- 10. Mukund Joshi, 2012. New Vistas of Organic Farming. Scientific Publishers Bangalore.
- 11. Singh, J.K. 2012. Mushroom Diseased and its control. Emkay Publishing House, New Delhi.
- 1. MSU / 2021-22 / PG Colleges / M.Sc.(Botany) / Semester-II / Ppr.no.10 / Core -10
- 12. Suman 2005. Mushroom Cultivation Processing and Uses. IBH Publishers and Distributors, New Delhi.
- 13. Pathal, V.K.N. Yadav and Gaur, M. 2000. Mushroom Production and Processing Technology.
- 14. Sharma, V.P. 2006. Disease and Pests of Mushrooms, IBH Publishers and Distributors, New Delhi.
- 15. Geeta Sumbali, 2010. The Fungi, Narosa Publishing House, Chennai.
- Rais AHMAD, 2009. WTO and Indian Agriculture Opportunities and Challenges (1-3 Vols) Mittal Publications, New Delhi.
- 17. Joshi, S.R. 2006. Biopesticides A Bio Technological Approach New Age International (P) Ltd. N.D.
- 18. Subba Rao, N.S. 1988. Bio Fertilizer in Agriculture, Oxford & IBH, New Delhi.
- 19. ICAR, 1987. Hand Book of Agriculture, New Delhi.
- 20. Rana M K 2014 Olericulture in India. Kalyani Publishers.
- 21. Pandey, B.P. 1999. Economic Botany. S.Chand Publishing, New Delhi.
- 22. Beena Nair, Krishnan Pal Singh, Prem Chand 2014 Fundamentals of Vegetable Crop Production, Scientific Publishers, India
- 23. Rajan Kumar Biswas 2014 Organic Farming in India. ND publishers.
- 24. Desh Raj 2017 Floriculture at a glance. Kalyani Publishers
- 25. Singh, V., Pande, P.C., Jain D.K. Economic Botany 2018 Rastogi Publications, Shivaji Road Meerut
- 26. Ravinder Singh Rana and Isha slathia, 2020. Mushroom Cultivation and its Diseases, Sankalp Publication.

Note :

- 1. Students may be encouraged to visit TNAU / 1CAR Research Stations.
- 2. Visiting websites.
- 3. Referring News Letter / Booklets of CSIR, TNAU, DBT.



4. Recommended Readings:- Velan Ulagam / Naveena Velanmai, Pasumai Vikadan, Tholil Nutpu, Thottakkalai, Herbal Bio Tech., and Hindu Survey of Agriculture.

Practical:(spotters)

- 1) .Kitchen garden/water garden/Rockery
- 2) Green house/Polyhouse/Glass house
- 3) Organic farming-Azolla cultivation/Vermicompost/Vermiwash
- 4) .Mushroom cultivation- Paddy straw/Oyster mushroom
- 5) Note on Funding agencies EDP/NABARD
- 6) Spotters for Economic Botany binomials of economically important plants, family, their parts and economic importance.

- 1. https://www.youtube.com/watch?v=YaPW_c2ANVg
- 2. https://www.youtube.com/watch?v=9u-UEqiUZtk
- 3. https://www.youtube.com/watch?v=UznYVl81dig
- 4. https://www.youtube.com/watch?v=X_hnfG2T5UY
- 5. https://www.youtube.com/watch?v=UA-lqWd7fPE
- 6. 6. https://www.youtube.com/watch?v=QTDVI99qLoo&t=649s



FIELD WORK

Prerequisite:

The students should be able to interpret the scientific ideas

Objectives:

- To provide training in scientific skills.
- To prepare students for professional training programmes

Outcome:

Students should have increased

- their capacity to think critically;
- their ability to design, analyse and execute an experiment;
- interpreting the data of their scientific experiments

PTERIDOPHYTES, GYMNOSPERMS, PALEOBOTANY, PLANT ANATOMY, EMBRYOLOGY AND MORPHOGENESIS

Pteridophytes, Gymnosperms and Paleobotany Practicals

Pteridophytes : Selaginella, Isoetes, Pteris, Salvinia and Azolla.

Fossil slides : Rhynia, Lepidodendron, Calamites. Gymnosperms : Cycas, Araucaria, Ginkgo, Taxus, Ephedra. Fossil slides : Lyginopteris, Heterangium, Cordaites and Medullosa.

To maintain a record note book for evaluation





Plant Anatomy, Embryology and Morphogenesis

Practicals

- 1. Anomalous activity of Cambium in Boerhaavia, Achyranthus and Dracaena.
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- 3. Leaf anatomy C3 (rice) C4 (Cynodon).
- 4. Dissection of globular/cordate embryo from suitable seed.
- 5. Any photographs/pictures of Plant Morphogenesis.

GENETICS, CELL BIOLOGY, ENTREPRENEURSHIP AND ECONOMIC BOTANY

Genetics and Cell Biology Practicals

Solving problems involving:

- 1. Simple Molecular biology problems based on the theory syllabus.
- 2. Interactions of genes.
- 3. Chromosome mapping from test cross data.
- 4. Sex determination, Sex linked inheritance.
- 5. Identification of different stages of meiosis from suitable plant material.
- 6. Interpretation of micrographs.
- 7. Study of mitotic index from suitable plant material

Entrepreneurship and Economic Botany

Practical: (Sptters)

- 1. Kitchen garden/water garden/Rockery
- 2. Green house/Polyhouse/Glass house
- 3. Organic farming-Azolla cultivation/Vermicompost/Vermiwash
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