BOARD OF STUDIES IN M.Sc. BOTANY
2022-2023

DEPARTMENT OF BOTANY

SYLLABUS FOR M.Sc. BOTANY

PITHAPUR RAJAH'S GOVERNMENT COLLEGE
Autonomous and Accredited with 'A' Grade by NAAC (3.17 CGPA)
KAKINADA – 533 001, Kakinada Dist., ANDHRA PRADESH

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
M.Sc – BOTANY, SEMESTER – III,
PAPER CODE: 301: TAXONOMY OF ANGIOSPERMS AND PLANT RESOURCE UTILIZATION

Theory
Taxonomy of Angiosperms

UNIT – I
Taxonomic hierarchy, species, genus, family and other categories; Principles used in assessing
relationship delimitation of taxa and attribution of rank; Species concepts
Nomenclature and ICBN Rules

UNIT – II
Systems of angiosperm classification: Phenetic versus phylogenetic system; Cladistics in taxonomy; relative merits and demerits of major systems of classification Takhtajan, Cronquist, Thorne and Dahlgren, APG system, α, and ω taxonomy

UNIT – III
Brief analysis of evolutionary tendencies: Ranales (Magnoliaceae, Nympheaeceae), Rosales (Fabaceae, Apiaceae), Centrospermae (Caryophyllaceae, Nyctaginaceae) Tubiflorae (Asteraceae, Lamiaceae) Amentiferae (Casuarinaceae,), Helobiales (Najadaceae, Anismataceae), Liliflorae (Liliaceae, Amaryllidaceae), Glumiflorae (Poaceae, Cyperaceae). Modern trends in Taxonomy: Embryology, Palynology, Microanatomy, Cytology, Phytochemistry.

Plant Resources Utilization and Diversity

UNIT – IV
Origin, Evolution, Botany and uses of

1.	Food Crops	:	Rice, Sugarcane, Maize
2.	Pulses	:	Red gram, Black gram
3.	Fibre Crops	:	Cotton, Sun hemp
4.	Medicinal and aromatic crops	:	Catheranthus, Withania, Cymbopogan
5.	Oil yielding crops	:	Groundnut, Castor, Brassica

SUGGESTED LABORATORY EXERCISES

Taxonomy of Angiosperms & Plant Resources Utilization and Diversity

1. Description of a Taxa /Species from representative and locally available families
2. Description of various species of a genus: Preparation of key character at genus level
3. Preparation of key characters and use of keys at family level
4. Field trips: Compilation of field notes and preparation of herbarium wild or cultivated
5. Training in using floras and herbaria for identification of specimens wild and cultivated
6. Taxonomic description of the following cultivated Crops

1. Food crops	:	Rice, Maize
2. Pluses	:	Red gram, Black gram
3. Fiber crops	:	Cotton, Sun hemp
4. Oil yielding	:	Groundnut, Castor, Brassica
5. Medicinal & Aromatic	:	Catheranthus, Eucalyptus

SUGGESTED READINGS & TEXT BOOKS

Taxonomy of Angiosperms

1. Cole, A.J. 1969. Numerical Taxonomy, Academic Pree, London
2. Davis, P.H. and Heywood, V.H. 1973. Principles of Angiosperms Taxonomy. Robert E Kreiger Pub. Co., New York
3. Harrison, H.J. 1971. New concepts in Flowering Plant Taxonomy, Hieman Educational Books Ltd., London
4. Simpson MG. 2006. Plant Systematics. Elsevier Academic Press, California, USA
5. Heywood, V.H. and Moore, D.M. 1984. Current concepts in Plant Taxonomy, Academic Press, London
6. Nordenstam BEI, Lazily G and Kassas M. 2000. Plant systematic for 2nd Century. Portland Press Ltd., London.
7. Jones, S.B. Jr. and Luchsinger, A.E. 1986. Plant Systematics (2 nd Edition) McGraw Hill Book Co., New York
8. Angiosperm Phylogeny Group website. 2012. consult www.apgweb.
9. Heywood, V.H., RK Brummitt, A. Culham, O. Seberg 2007. Flowering Plant Families of the World. Firefly books Ltd. New York.
10. Judd, W. S, Christopher S. Campbell, Elizabeth A. Kellogg, Peter F. Stevens, and Michael J.Donoghue. 2007. Plant Systematics: A Phylogenetic Approach, 3rd ed. Sinauer.
11. Lawrence, G.H.M 1951. Taxonomy of vascular plants. McMillan, New York.

Plant Resources Utilization and Diversity

1. Baker, H.G. 1978. Plants and Civilization (3rd Edition) C.A. Wadsworth, Belmont Chrispeels, M.J. and Sadava, D. 1977. Plants, Food and People. W.H. Freeman and Co., San Francisco
2. Cinway, G. 1999. The Doubly Green Revolution. Food for All in the 21st Century, Penguin Books.
3. Council of Scientific & Industrial Research 1986. The useful plants of India. Publications and Information Directorate. CSIR, New Delhi
4. Council of Scientific & Industrial Research (1948-1976). The Wealth of India. A Dictionary of Indian Raw materials and Industrial products, New Delhi, Raw materials I-XII Revised Vol. I-III (1985-1992) supplement (2000).
5. Pinstrup – Anderson, P. et al. 1999. World Food Prospects: Critical Issues for the Early 21ST Century. International Food Policy Research Institute, Washington, D.C., USA.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
M.Sc – BOTANY, SEMESTER – III,
PAPER CODE: 302: PLANT DEVELOPMENT AND REPRODUCTION

Theory
Plant Development

UNIT – I
Tissues: Simple and complex tissues. Epidermis- stomata, trichomes. Secretory cells
Shoot Development: Organization of the shoot Apical meristem [SAM]; cytological and molecular analysis of SAM. Leaf Growth and Differentiation: Differentiation of epidermis and mesophyll.

UNIT – II
Root Development: Organization of root apical meristem [RAM], Tissue differentiation; Lateral roots and root hairs, Root microbe interactions.
Cambium: Structure, cell types and development of vascular cambium, Cork cambium - structure of its derivatives; bark. Anomalous secondary growth in dicot and monocot stems
Vascular Tissue Development: development and structure of Primary Xylem, Primary Phloem, Secondary Xylem, Secondary Phloem

Reproduction

UNIT – III
Male Gametophyte: Structure of anther; microsporogenesis; Types and role of tapetum; pollen development, Sperm dimorphism; Pollen embryo sacs.
Female Gametophyte: Types of Ovule, development of Ovule, Megasporogenesis, Types of Embryo sacs, Organization of Embryo sac; ultra-structure of the embryo sac cells.
Pollination, Pollen-pistil interaction: Structure of pistil; pollen-stigma interactions; self-incompatibility, different methods to overcome self-incompatibility.

UNIT – IV
Fertilization: Pollen germination; pollen tube growth and guidance; Entry of pollen tube into the embryo sac; pollen tube discharge, syngamy and triple fusion; polyspermy and hetero fertilization.
Post-fertilization events: Endosperm development; Types of Endosperm; Functions; Endosperm and embryo relationships, Embryo development: Johanson and Soueges system types. Polyembryony; Apomixis; Parthenocarpy, Seed dormancy.

SUGGESTED LABORATORY EXERCISES

Plant Development

1. Microscopic studies of Leaf Anatomy: Nerium, Maize observation of trichomes, glands. Study of C3 and C4 plant anatomy
2. Study of Stomatal types and determination of Stomatal frequency and Stomatal Index
3. Study of wood anatomy, macerations and sections, T.S., T.L.S. and R.L.S
4. Study of anomalous growth of stems: Aristolochia, Achyranthes, Bignonia, Boerhaavia, Leptodenia and Dracaena

Reproduction

1. Study of microsporogenesis and gametogenesis in anthers
2. Tests for pollen viability using stains and in vitro germination
3. Slide preparation of Embryo sac
4. Slide preparation of nuclear and cellular endosperm
5. Tests for Seed viability

SUGGESTED READINGS & TEXT BOOKS

Plant Development

1. Bailey, J.D. and Black, M. 1994. Seeds: Physiology of development and Germination, Plenum Press, New York.
2. Fahn, A. 1982. Plant Anatomy. (3rd edition). Pergamon Press, Oxford
3. Fosket, D.E. 1004. Plant Growth and Development. A Molecular approach. Academic Press, San Diego
4. Howell, S.H. 1998. Molecular Genetics of Plant Development Cambridge University Press
5. Lyndon, R.F. 1990. Plant Development. The Cellular Basis. Uni Hyman, London
6. Mauseth, J.D. 1988. Plant Anatomy. Benjamin Cummings. California
7. Pullaiah, T., Naidu, K.C., Lakshminarayana, K and Hanumantha Rao, B. 2007. Plant Development. Regency Publications, New Delhi
8. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology (4th edition) Wordsworth Publishing, Belmont, Calfornia
9. Steeves, T.A. and Susses, I.M. 1989. Patterns in Plant Development (2nd edition), Cambridge University Press, Cambridge
10. Waisel, Y., Eshel, A. and Kafkaki, V. (eds) 1996. Plant Roots: The Hidden Hall (2nd edition). Marcel Dekker, New York

Reproduction

1. Johri, B.M 1984. Embryology of Angiosperms springer-Veriag. Berlin
2. Johri, B.M. 1981. Experimental embryology of vascular plants. Springer Verlag, Berlin
3. Maheshwari, P. 1980. An introduction to the Embryology of Angiosperms, Tata,mccrawin
4. Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition) Vikas Publishing House, New Delhi

5. Leins, P., Tucker, S.C. and Endress. P.K. 1988. Aspects of Floral Development. J. Cramer, Germany
6. Procter, M. and Yeo, P. 1973. The Pollination of Flowers. William Collins Sons, London
7. Pulliah, T., Lakshminarayana, K and Hanumantha Rao, B., 2008. Plant Reproduction, Scientific Publishers, Jodhpur, India
8. Raghavan, V. 1997. Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridge
9. Raghavan, V. 1999. Developmental Biology of Flowering Plants. Springer – Verlag, New York
10. Sedgely, M. and Griffin, A.R. 1989. Sexual Reproduction of Tree Crops, Academic Press, London
11. Shivanna, K.R. and Swahney, V.K. (Eds.) 1997. Pollen Biotechnology for Crop Production and Improvement. Cambridge University Press, Cambridge
12. Shivanna, K.R. and Rangaswamy, N.S. 1992. Pollen Biology, A Laboratory Manual. Springer-Verlag, Berlin
13. Shivanna, K.R. and Johri, B.M.1985. The Angiosperm Pollen Structure and Function, Wiley Eastern Ltd., New Delhi
14. The Plant Cell. Special Issue on Reproductive Biology of pants, Vol.5 (10) 1993. The American Society of Plant Physiologists, Rockville, Maryland, USA

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
M.Sc – BOTANY, SEMESTER – III,
PAPER CODE: 303: PLANT ECOLOGY, BIODIVERSITY AND CONSERVATION

Theory

UNIT – I

Ecology – A synthetic approach. Major biomes and Vegetational patterns of the World. Major Vegetational and Soil types of India.

Community ecology: Methods of study of plant communities, qualitative study of plants communities. Stratification of Life forms and physiognomy, normal biological spectrum.

UNIT – II

Quantitative study of plant communities, distribution pattern frequency, density, canopy, basal area and cover

Synthetic characters of Community, Similarity Index, general account of classification of communities

Population Ecology: Population structure, characteristics of population; population density, Natality, Mortality, Age distribution, Biotic potential, Population growth forms and curves. Population fluctuation and population dispersal

UNIT – III

Plant Biodiversity: Concept, Status in India, Utilization and concerns, World Centers of primary diversity of domesticated plants. The Indo Burmese Centre, plant introduction and secondary centers.

UNIT – IV

Principles of Conservation: Strategies for conservation, in situ conservation, protected areas in India- Biosphere reserves, wetlands, mangroves, conservation of wild biodiversity, strategies for conservation – ex situ conservation. Principles and practices. Botanical gardens, BSI, ICAR and CSIR.

SUGGESTED LABORATORY EXERCISES

1. Study vegetation in the botanical gardens
2. To prepare life forms of local botanical gardens and prepare a biological spectrum
3. To determine the minimal size and number of quadrates required for reliable estimate of biomass in grass land
4. Quantitative analysis of vegetation: relative frequency, density, relative density, basal area and IVI
5. To estimate rate of Carbon dioxide evolution from different soils using soda lime or alkali absorption method
6. Scientific visits:
   A protected areas or Biosphere reserve or national park or sanctuary
   A wetland, Mangrove, NBPGR (National Bureau of Plant Genetic Resources – New Delhi) BSI, CSIR Laboratories, FRI and Tropical Botanical Gardens

SUGGESTED READINGS & TEXT BOOKS

1. APHA – Standard Methods for the Examination of Water and Waste Water. American Public Health Association, Washington, DC
2. Frankel, OH. Brown, A.H.D. & Burdon, J.J. 1995. The conservation of Plant Diversity, Cambridge University Press, Cambridge, UK
3. Krebs, C.J. 1989. Ecological Methodology. Harper and Row, New York, USA
4. Ludwig, J.A. and Reynolds, J.F. 1988. Statistical Ecology. Wiley, New York
5. Magurran, A.E. 1988. Ecological Diversity and its measurement. Chapman and Hall, London
6. Moore, P.W. and Chapman, S.B. 1986. Methods in Plant Ecology Blackwell Scientific Publication
7. Molles, M.C. 2005. Ecology-concepts and applications. Mc GrawHill. Boston
8. Muller – Dombois, DD. And Ellenberg, R. 1974. Aims and Methods of Vegetation Ecology, Wiley, New York
9. Begon Michael, Colin Townsend & John L. Harper. 2005. Ecology, From Individuals to Ecosystems. 4th ed.Black well Publishing, Oxford.
10. Odum.E.P. & Gary W.Barrett. 2005. Ecology.Tomson Brooks/Cole, Singapore.
11. Sokal, R.R. and Rohit, F.J.1995. Biometry. W.H. Freeman & Co., San Francisco
12. Cunningham, W.P. & M.A.Cunningham 2007. Principles of Environmental Science-Inquiry and applications. Tata Mc GrawHill Pub.New Delhi.
13. Heywood, V.M. and Watson, R.T. 1985. Global Biodiversity Assessment, Cambridge Univ. Press, Cambridge.
14. Ricklefs, R, E. &Gary L. Miller. 2000.Ecology. 4th ed. W.H. Freeman and Company. New York
15. Richard T. Wight 2005. Environmental Science. 9th ed. Pearson Prentice Hall. New Delhi.
16. Given, D.R. 1995. Principles and practice of plant conservation. Timber Press, Oregon
17. Jensen, John R. 2007. Remote Sensing of the Environment: An Earth Resource Perspective.PHI.
18. Sabins, F.F.2007. Remote Sensing-principles and interpretation. 3rded. Waveland Press Inc

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
M.Sc – BOTANY, SEMESTER – III
PAPER CODE: 304: PLANT PHYSIOLOGY

Theory

UNIT – I

Plant water Relations: Thermodynamic concepts of plant water relations, free energy and chemical, osmotic and water potential, active and passive absorption of water, stomatal physiology and stomatal opening and closing, Soil-plant-atmosphere-continuum concept (SPAC) and mechanism of water transport

Mineral Nutrition: Passive and active uptake of ions, translocation of minerals in plants, essential elements, their functions and symptoms of mineral deficiency, importance of foliar nutrition and use of chelates in agriculture, root microbe interactions in facilitating nutrient uptake and mechanism of assimilation

UNIT – II

The physiology of flowering: Phytochrome structure, photochemical and biochemical properties and role in photo morphogenesis, photoperiodism and its significance, mechanisms of floral induction, role of vernalization, morphological, biochemical and metabolic changes accompanying seed germination, causes and methods of breaking seed dormancy

UNIT – III

Plant growth regulators and Elicitors: Biosynthesis, physiological effects and mechanism of action auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, polyamines, jasmonic acid and salicylic acid, role in agri-horticulture, and hormone receptors

UNIT – IV

Stress Physiology: Plant responses to biotic and abiotic stress, mechanisms of biotic and abiotic stress tolerance, water deficit and drought resistance, salinity stress, metal toxicity, heat stress and oxidative stress

SUGGESTED LABORATORY EXERCISES

1. Effects of high and low temperatures on the permeability of the cytoplasmic membranes
2. Determination of suction force in transpiration
3. Stomatal frequency and Stomatal index of leaves
4. Rate of transpiration in leaves by Cobalt chloride paper method
5. Mechanism of opening and closing of stomata

SUGGESTED READINGS & TEXT BOOKS

1. Sinha SK 2014.A text book of Plant Physiology. Centrum Press, New Delhi.
2. Seema Yadav 2014. Plant Physiology. SBW publishers, New Delhi.
3. Heribert H and Kazuo S (eds) 2010. Plant responses to abiotic stress. Series Topics in Current Genetics, Vol 4. Springer, Berlin.
4. Philip Stewart and Schine Gobig 2011. Plant Physiology. CRC Press.
5. Moore TC. 2011. Biochemistry and Physiology of Plant Hormones. Springer, New York.
6. Mohr H and Schopfer P. 1995. Plant Physiology. Springer-Verlag, New York.
7. Witham FH and Devlin RM. 1986. Plant Physiology. CBS Publishers and Distributors, Bangalore.
8. Wilkins MD. 1987. Advanced Plant Physiology. English Language Book Society, Longman Scientific and Technical, Harlow, UK.
9. Ting IP. 1982. Plant Physiology. Addison-Wesley, Reading, MA.
10. Murthy HNK. 1981. Plant growth substances including applications in Agriculture. Tata McGraw Hill Publishing Company Ltd., New Delhi.
11. Kramer PM and Kozlowski TT. 1980. Physiology of Woody Plants. Academic Press, New York.
12. Hillman WS. 1963. Physiology of Flowering. Holt, Reinhart and Winston, New York.
13. Kocchar and Gujral. 2012. Comprehensive Plant Physiology. McMilan Pub.
14. Salisbury F. B. & C. W. Ross 1992 Plant Physiology. 4 th Edn. Wadsworth Publishing Co., Belmout, California.
15. Wiltmer, C.M. & M. Fricker. 1996. Stomata. 2nd Ed. Chapman Hall. U. K.
16. Audus, L.J. 1972. Plant Growth Substances, Volume 1. Chemistry and Physiology. Leonard Hill, UK
17. Bewley, J.D. and Black, M. 1982. Physiology and Biochemistry of seed in relation to germination and dormancy. Volume 1& 2, Springer – Verlag, Berlin
18. Devlin, R.M. and Witham, F.H. 1986. Plant Physiology
19. Davies, P.J. (Ed) 1987. Plant hormones and their role in Plant Growth and Development. Mertinus Nijh off Publishers, The Netherlands
20. Epstein, E. 1972. Mineral nutrition of plants, Principles and prospectus, John Willey & Sons, INC, New York
21. Frank Boyer Salisbury, Cleon Ross. Plant Physiology, 5th Edition.
22. Hess, D. 1974. Plant Physiology
23. Hewit, E.J. and T.A. Smith, 1975. Plant Mineral Nutrition
24. Hooykaas, P.J.J., Hall, M.A. and Libbenga, K.R. (Eds.) 1999. Biochemistry and Molecular Biology of Plant Hormones, Elsevier, Amsterdam, The Netherlands
25. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons Including New York, USA
26. Hopkins, W.G. 2009. Introduction to Plant Physiology. John Wiley & Sons Including New York, US, 4th Edition.

27. Konrad Mengel, Ernest A. Kirkby, Harald Kosegarten, Thomas Appel. Principles of Plant Nutrition, 5th Edition
28. Khan, A.A. 1982. The Physiology and Biochemistry of Seed Development, Dormancy and Germination. Elsevier, Amsterdam, The Netherlands
29. H.N. Krishna Murthy. 1981. Plant growth substances including applications in Agriculture. Tata McGraw – Hill Publishing Company Ltd
30. Irwin P. Ting, Plant Physiology, 1982, Addison-Wesley Publishing Company.
31. Leopold, A.C. 1964. Plant growth and development. Mc Graw Hill Book Company, Inc, New York.
32. Meyer, A.M. and A. Poljakoff Mayber. 1975. The germination of Seeds
33. Noggle, G.R. and G.J. Fritz. 1991. Introductory plant physiology (2nd edition) Prentice hall of India Limited
34. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology (4th edition). Wordsworth Publishing Company, Belmont, California, USA
35. Slayter, R.O. 1967. Plant Water Relationships. Academic Press, New York
36. Sutcliffe, J.F. 1962. Mineral slats absorption in plants, Bergamen, Press, Oxford, London
37. Taiz, L. and Zeiger, E. 1998. Plant Physiology (2nd edition). Sinauer Associates including Publishers, Massachusetts, USA
38. Thomas and Vince – Prue, D. 1997. PhotoPeriodism in Plants (2nd edition). Academic Press, Sandeigo, USA
39. Wilkins, M.D. 1987. Advanced Plant Physiology. English Language Book Society, Longman
40. Wisthoff, P. 1998. Molecular Plant Development from Gene to Plant. Oxford University Press, Oxford, UK