

ANDHRA KESARI UNIVERSITY

BOTANY: MINOR

w.e.f 2023-24 AY onwards

COURSE STRUCTURE

Year	Semester	Course	Title	No. Hrs./ Week	No. of Credits
	II	1	Non-vascular Plants –(T)	3	3
			Non-vascular Plants –(P)	2	1
II	III	2	Vascular Plants –(T)	3	3
			Vascular Plants –(P)	2	1
	IV	3	Anatomy and Embryology of Angiosperms–(T)	3	3
			Anatomy and Embryology of Angiosperms–(P)	2	1
		4	Plant Ecology, Biodiversity and Phytogeography–(T)	3	3
			Plant Ecology, Biodiversity and Phytogeography–(P)	2	1

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Semester III

Course 2 : Vascular Plants (Pteridophytes, Gymnosperms and Taxonomy of Angiosperms)

Credits -3

I. Learning Objectives: By the end of this course the learner has:

1. To recognize the morphology, anatomy and reproduction in two groups of archegoniates.
2. To acquire knowledge of the taxonomic aids and classification systems.
3. To read the vegetative and floral characteristics of some forms of angiospermic families along with their economic value.
4. To study the significance of other branches of botany in relation to plant taxonomy.

II. Learning Outcomes: On completion of this course students will be able to:

1. Infer the evolution of vasculature, heterospory and seed habit in Pteridophytes.
2. Illustrate the general characteristics of Gymnosperms along with their uses
3. Discuss about some Taxonomic aids and their applications in plant systematics.
4. Compare and contrast the vegetative and floral characteristics of some angiospermic families
5. Evaluate the economic value of plant species from the families under the study.
6. Defend the utility of evidences from different branches of botany in solving the taxonomic lineages of some species.

III. Syllabus of Theory:

Unit-1: Pteridophytes

10Hrs.

1. General characteristics of Pteridophyta; Smith (1955) classification.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life history of: (a) Lycopsida: *Lycopodium* and (b) Filicopsida: *Marsilea*
3. Stellar evolution in Pteridophytes; Heterospory and seed habit.
4. Ecological and economic importance of Pteridophytes.

Unit-2: Gymnosperms

10Hrs.

1. General characteristics of Gymnosperms; Sporne (1965) classification.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life history of: (a) Cycadopsida: *Cycas* and (b) Gnetopsida: *Gnetum*
3. Ecological and economic importance of Gymnosperms.

Unit-3: Principles of Plant Taxonomy

10 Hrs.

1. Aim and scope of taxonomy, species concept, taxonomic hierarchy-major and minor categories.
2. Plant nomenclature: Binomial system, ICBN- rules for nomenclature.
3. Herbarium and its techniques, BSI herbarium and Kew herbarium; concept of digital herbaria.
4. Bentham and Hooker system of classification.
5. Phylogenetic systematics: primitive and advanced, homology and analogy, parallelism and convergence, monophyly, paraphyly, polyphyly, clades. synapomorphy, symplesiomorphy, apomorphy. APG-IV classification.

Unit-4: Descriptive Plant Taxonomy

8 Hrs.

Systematic description and economic importance of the following families:

1. Polypetalae: (a) Annonaceae (b) Curcubitaceae
2. Gamopetalae: (a) Asteraceae (b) Asclepiadaceae
3. Monochlamydae: (a) Amaranthaceae (b) Euphorbiaceae
4. Monocotyledonae: (a) Arecaceae (b) Poaceae

Unit-5: Evidences for Plant systematics

7Hrs.

1. Anatomy and embryology in relation to plant systematics.
2. Cytology and cytogenetics in relation to plant systematics.
3. Phytochemistry in relation to plant systematics.
4. Numerical taxonomy
5. Origin and evolution of angiosperms.

IV. Text Books:

1. Acharya, B.C., (2019) Archchegoniates, Kalyani Publishers, New Delhi
2. Bhattacharya, K., G. Hait&Ghosh, A. K., (2011) A Text Book of Botany, VolumeII, New Central Book Agency Pvt. Ltd., Kolkata
3. Hait,G., K.Bhattacharya&A.K.Ghosh (2011) A Text Book of Botany, Volume-I, New Central Book Agency Pvt. Ltd., Kolkata
4. Pandey, B.P. (2013) College Botany, Volumes-I&II, S. Chand Publishing, New Delhi

V. Reference Books:

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1. Smith, G.M. (1971) Cryptogamic Botany Vol. II., Tata McGraw Hill, New Delhi
2. Sharma, O.P. (2012) Pteridophyta. Tata McGraw-Hill, New Delhi
3. Sporne, K.R. (1971) The Morphology of Gymnosperms. Hutchinsons Co. Ltd., London
4. Coulter, J.M. & C.J. Chamberlain (1910) Morphology of Gymnosperms, The University of Chicago Press, Chicago, Illinois
5. Bhatnagar, S.P. & Alok Moitra (1996) Gymnosperms. New Age International, New Delhi
6. Sambamurty, A.V.S.S. (2005) Taxonomy of Angiosperms I. K. International Pvt. Ltd., New Delhi
7. Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi.
8. Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, San Diego, CA, U.S.A.

VI. Suggested activities and evaluation methods:

Unit-1: Activity: Making temporary slides/models/drawings of Pteridophytes in the syllabus.

Evaluation method: Assessment of the temporary slides/model/drawing.

Unit-2: Activity: Study of wood elements in locally available Gymnosperms and making temporary slides.

Evaluation method: Validation of prepared slides submitted by the learner.

Unit-3: Activity: Botanical field trip and collecting plant specimens for herbarium.

Evaluation method: Attendance in field trip and submission of field note book and herbarium sheets with filled in labels.

Unit-4: Activity: Making good models or drawings or collection of photographs of some important plant species from the families included in the syllabus.

Evaluation method: Authorize the quality of the work and conferring reward.

Unit-5: Activity: Collection of scientific literature on solving taxonomic problems by taking evidences from other branches of Botany.

Evaluation method: Validation of the collection submitted along with summary.

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III Semester

Course 2 : Vascular Plants (Pteridophytes, Gymnosperms and Angiosperm Taxonomy)

Credits -1

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Distinguish the Pteridophytes and Gymnosperms based on their morphological, anatomical and reproductive structures.
2. Make systematic classification of plant species using vegetative and floral characters.
3. Identify angiosperm plant species and make herbarium specimens.

II Laboratory/field exercises:

I. Study/ microscopic observation of vegetative, sectional/anatomical and reproductive structures of the following using temporary or permanent slides/specimens/ mounts:

1. Pteridophyta: *Lycopodium* and *Marselia*
2. Gymnosperms: *Cycas* and *Gnetum*

II. Technical description of locally available plant species from the following angiosperm families:

- | | | | |
|------------------|------------------|---------------|-------------------|
| 1. Annonaceae | 2. Cucurbitaceae | 3. Asteraceae | 4. Asclepiadaceae |
| 5. Amaranthaceae | 6. Euphorbiaceae | 7. Arecaceae | 8. Poaceae |

III. Demonstration of herbarium techniques.

IV. Field trip to a local floristic area/forest (Submission of 30 number of Herbarium sheets of wild plants with the standard system are mandatory).

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IV Semester
Course 3: Anatomy and Embryology of Angiosperms
Credits -3

I. Learning Objectives: By the end of this course the learner has:

1. To know about various types of tissues in plants and their organization.
2. To obtain awareness on anomalous secondary growth in plants and economic value of woods.
3. To acquire knowledge on development of male and female gametophytes in plants.
4. To probe into embryogenesis in angiosperms.

II. Learning Outcomes: On completion of this course students will be able to:

1. Categorize various tissues and evaluate their role in plants.
2. Explain anomalous secondary growth in some plants and justify the value of timber plants.
3. Summarize the events in micro-sporogenesis and development of male gametophyte.
4. Discuss the events in mega-sporogenesis and development of female gametophyte.
5. Propose the incidents in embryogenesis of an angiospermic plant species.
6. Compile the aspects of developmental and reproductive biology in plants.

III. Syllabus of Theory:

Unit – 1: Tissues in plants

8 Hrs.

1. Meristematic tissues: Definition, classification, structure and functions.
2. Apical meristems: Generalised structure of shoot apex, theories on organization of Shoot Apical Meristem (SAM) - Apical cell theory, Tunica-Corpus theory and Histogen theory.
3. Permanent tissues (simple and complex).
4. A brief account of plant secretory tissues/cells.

Unit-2: Anomalous growth in plants

10Hrs.

1. Tissue systems—Epidermal, ground and vascular.
2. Anomalous secondary growth in root of *Beta vulgaris*
3. Anomalous secondary growth in stems of *Boerhaavia* and *Dracaena*
4. Study of timbers of economic importance - Teak, Red-sanders and Rosewood.
5. Applications of anatomy in plant systematics, forensics and pharmacognosy.

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Unit-3: Anther and pollen**10Hrs.**

1. Anther: Structure and functions of anther wall, micro-sporogenesis, callose deposition and its significance.
2. Pollen wall structure, MGU (male germ unit) structure, NPC system; a brief account of Palynology and its scope; development of male gametophyte.
3. Pollen wall proteins; Pollen viability, storage and germination; Abnormal features: pseudomonads, polyads, massulae, pollinia.

Unit-4: Ovules, fertilization and endosperm**10Hrs.**

1. Structure and types of ovules, megasporogenesis; monosporic (*Polygonum*), bisporic (*Allium*) and tetrasporic (*Peperomia*) types of embryo sacs.
2. Outlines of pollination; self-incompatibility- basic concepts; methods to overcome self-incompatibility (mixed pollination, bud pollination, stub pollination).
3. Double fertilization in angiosperms – process and consequences.
4. Perisperm; endosperm – types (free nuclear, cellular, helobial and ruminant) and biological importance.

Unit-5: Embryogeny and seeds**7Hrs.**

1. Embryogeny in dicot (*Capsella bursa-pastoris*)
2. Embryogeny in monocot (*Sagittariasagittifolia*).
3. Seed structure in monocot and dicot.
4. Importance of seed and seed dispersal mechanisms.
5. Polyembryony and apomixes: Introduction, classification, causes and applications.

IV. Text Books:

1. Pandey, B.P. (2013) College Botany, Volumes-II& III, S. Chand Publishing, New Delhi
2. Bhattacharya, K., G. Hait & Ghosh, A. K., (2011) A Text Book of Botany, Volume-II, New Central Book Agency Pvt. Ltd., Kolkata

V. Reference Books:

1. Esau, K. (1971) Anatomy of Seed Plants. John Wiley and Son, USA.
2. Fahn, A. (1990) Plant Anatomy, Pergamon Press, Oxford.
3. Cutler, D.F., T. Botha & D. Wm. Stevenson (2008) Plant Anatomy: An Applied



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Approach, Wiley, USA

4. Paula Rudall (1987) Anatomy of Flowering Plants: An Introduction to Structure and Development. Cambridge University Press, London
5. Bhojwani, S. S. and S. P. Bhatnagar (2000) The Embryology of Angiosperms (4th Ed.), Vikas Publishing House, Delhi.
6. Pandey, A. K. (2000) Introduction to Embryology of Angiosperms. CBS Publishers & Distributors Pvt. Ltd., New Delhi
7. Maheswari, P. (1971) An Introduction to Embryology of Angiosperms. McGraw Hill Book Co., London.
8. Johri, B.M. (2011) Embryology of Angiosperms. Springer-Verlag, Berlin

VI. Suggested activities and evaluation methods:

Unit-1: Activity: Microscopic observations on different tissues in plants and recording characteristics.

Evaluation method: Judgement of the report/seminar on comparative and contrasting features of various tissues in plants.

Unit-2: Activity: Visits to timber depots and furniture shops and making a report on various woods.

Evaluation method: Assessment of report submitted with data, photographs and summary.

Unit-3: Activity: Study of pollen structure, germination and viability in some local plant species.

Evaluation method: Evaluating the report/seminar presentation with collected data.

Unit-4: Activity: Group discussion/quiz on endosperm types and functions.

Evaluation method: Assessment of the best performing group.

Unit-5: Activity: Drawings of embryogeny in some angiosperms and making comparative report.

Evaluation method: Evaluating the best drawings and comparative report.

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IV Semester

Course 3: Anatomy and Embryology of Angiosperms

Credits -1

Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Conduct dissections of various plant organs and study the internal structures by staining.
2. Look into the embryological characteristics from sex organs to seeds in angiosperms.

Laboratory/field exercises:

1. Observation of meristems in dicot and monocot plants.
2. Tissue organization in shoot apices using permanent slides.
3. Anomalous secondary growth in root of *Beta vulgaris*
4. Anomalous secondary growth in stems of *Boerhaavia* and *Dracaena*.
5. Study of anther and ovules using permanent slides/photographs.
6. Study of pollen germination and pollen viability.
7. Dissection and observation of embryo sac haustoria in *Santalum* or *Argemone*.
8. Structure of endosperm (nuclear and cellular) using permanent slides/photographs.
9. Dissection and observation of Endosperm haustoria in *Crotalaria* or *Coccinia*.
10. Developmental stages of dicot and monocot embryos using permanent slides /photographs.

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IV Semester

Course 4: Plant Ecology, Biodiversity and Phytogeography

Credits -3

I. Learning Objectives: By the end of this course the learner has:

1. To figure-out the components of ecosystem and energy flow among different trophic levels.
2. To apprise the characteristics of autecology and synecology.
3. To understand the climatic change and associated impacts on biotic components.
4. To discern the value of biodiversity, threats and conservation strategies.
5. To know the distribution of various plant groups in different geographical areas.

II. Learning Outcomes: On completion of this course students will be able to:

1. Explain the interactions among the biotic and abiotic components in an ecosystem.
2. Summarize the characteristics of a population and a community.
3. Anticipate the environmental problems arising due to climate change.
4. Assess the value of biodiversity and choose appropriate conservation strategy.
5. Make a survey on the distribution of various plant groups in a specified geographical area.

III. Syllabus of Theory:

Unit-1: Basic concepts in ecology

10 Hrs.

1. Ecology: definition, branches and significance; relation with other sciences.
2. Structure and functions of ecosystems- abiotic and biotic components; flow of energy.
3. Cycling of materials: water, carbon, nitrogen and phosphorus; trophic pyramids, food chains and food webs.
4. Plants and environment: Climatic (light and temperature) and edaphic.
5. Interactions among plants; interactions between plants and animals.

Unit-2: Population and community ecology

10Hrs.

1. Population ecology: definition, characteristics -natality, mortality, growth curves, ecotypes, ecads.
2. Community ecology: characteristics -frequency, density, cover, life forms, competition, biological spectrum.

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3. Ecological succession: Hydrosere and Xerosere.
4. Concepts of productivity: GPP, NPP and Community Respiration
5. Secondary production, P/R ratio and Ecosystems.

Unit-3: Climate change-impacts

8Hrs.

1. Soil degradation – causes, consequences and management strategies.
2. Deforestation, forest fires – causes, consequences and management strategies.
3. Global warming, ozone layer depletion, acid rains, ocean acidification – causes and effects.
4. Carbon foot prints and carbon credits; The Montreal and the Kyoto protocol.
5. Plant indicators and their role in environmental monitoring.

Unit-4: Concepts of Biodiversity

10Hrs

1. Biodiversity: Basic concepts, Convention on Biodiversity - Earth Summit.
2. Value of Biodiversity; types and levels of biodiversity and Threats to biodiversity
3. Biodiversity Hot spots in India: North Eastern Himalayas and Western Ghats.
4. Principles of conservation: IUCN threat-categories, RED data book
5. Role of NBPGR and NBA in the conservation of Biodiversity.

Unit-5: Phytogeography

7 Hrs.

1. Principles of Phytogeography, Distribution (wides, endemic, discontinuous species)
2. Endemism – types and causes.
3. Phytogeographic regions of World.
4. Phytogeographic regions of India.
5. Vegetation types in Andhra Pradesh.

IV. Text Books:

1. Pandey, B.P. (2013) College Botany, Volumes- II & III, S. Chand Publishing, New Delhi
2. Bhattacharya, K., G. Hait & Ghosh, A. K., (2011) A Text Book of Botany, Volume II, New Central Book Agency Pvt. Ltd., Kolkata
3. N.S.Subrahmanyam & A.V.S.S. Sambamurthy (2008) Ecology Narosa Publishing House, New Delhi
4. Sharma, P.D. (2012) Ecology and Environment. Rastogi Publications, Meerut, India.
5. U. Kumar (2007) Biodiversity: Principles & Conservation, Agrobios (India)

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6. Mani, M.S (1974) Ecology & Biogeography of India Dr. W. Junk Publishers, The Hague

V. Reference Books:

1. Kormondy, Edward J. (1996) Concepts of Ecology, Prentice-Hall of India Private Limited, New Delhi
2. Begon, M., J.L. Harper & C.R. Townsend (2003) Ecology, Blackwell Science Ltd., U.S.A.
3. Eugene P. Odum (1996) Fundamentals of Ecology, Natraj Publishers, Dehradun
4. Kumar, H.D. (1992) Modern Concepts of Ecology (7th Edn.), Vikas Publishing Co., New Delhi.
5. Newman, E.I. (2000): Applied Ecology Blackwell Scientific Publisher, U.K.
6. Chapman, J.L & M.J. Reiss (1992): Ecology - Principles & Applications. Cambridge University Press, U.K.
7. Kumar H.D. (2000) Biodiversity & Sustainable Conservation Oxford & IBH Publishing Co Ltd. New Delhi.
8. Cain, S.A . (1944) Foundations of Plant Geography Harper & Brothers, N.Y.
9. Good, R. (1997) The Geography of flowering Plants (2nd Edn.) Longmans, Green & Co., Inc., London & Allied Science Publishers, New Delhi

VI. Suggested activities and evaluation methods:

Unit-1: Activity: Field visit to local ecosystems and making a report on biotic and abiotic components and their interactions.

Evaluation method: Valuation of record of attendance and report submission with conclusions

Unit- 2: Activity: Case studies on population and community ecologies and making a comprehensive report

Evaluation method: Assessing the report and awarding grade

Unit -3: Activity: Case studies on global and local climatic changes and their impacts, preparing a comprehensive report.

Evaluation method: Assessing the report and awarding grade.

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Unit- 4: Activity: Making a survey in their locality to identify endangered and threatening species.

Evaluation method: Assessing the survey report and assigning a grade based on a rubric.

Unit-5: Activity: Collection of data on flora of their locality and preparing a project report.

Evaluation method: Assessing the project report and awarding a grade.

Semester IV

Course 4: Plant Ecology, Biodiversity and Phytogeography

Credits -1

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Handle instruments used in ecological studies.
2. Perform experiments and collect data on autecology and synecology.
3. Identify various plant groups based on their morphological and anatomical adaptations.
4. Collect data on biodiversity and phytogeography.

II. Laboratory/field exercises:

1. Study of instruments used to measure microclimatic variables;
 - a. Soil thermometer,
 - b. Maximum and minimum thermometer,
 - c. Anemometer,
 - d. Rain gauge
 - e. Lux meter.
2. Visit to the nearest/local meteorology station where the data is being collected regularly and record the field visit summary for the submission in the practical.
3. Study of morphological and anatomical adaptations of any two hydrophytes.
4. Study of morphological and anatomical adaptations of any two xerophytes.
5. Quantitative analysis of herbaceous vegetation in the college campus for frequency, density and abundance
6. Identification of vegetation/various plants in college campus and comparison with

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Raunkiaer's frequency distribution law.

7. Find out the alpha-diversity of plants in an area
8. Mapping of biodiversity hotspots of the world and India.
9. Mapping of phytogeographical regions of the globe and India.

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ANDHRA KESARI UNIVERSITY-ONGOLE, PRAKASAM DISTRICT
Minor Programme from the Year 2023-24 Onwards
Programme-B.Sc. Honours Botany - Question Paper model,
Second Year-Semester-III & IV

Time: 3 Hours

Total Marks: 75

PART –A

Out of Ten Answer any Five of the following

5X5=25 Marks

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10

PART –B

Answer Any Five of the following

5x10=50 Marks

- 11.
- 12.
- 13.
- 14.
- 15.
- 16.
- 17.
- 18.
- 19.
- 20.

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