

**Syllabus
Admitted Batch 2008 -2009
Botany
(UG courses)**



Andhra University

**May 2008
A.P. State Council of Higher Education**

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CURRICULUM***B.Sc. Courses (Structure)******First year:***

S.no.	Subject	Hrs per week
1.	English language including communication skills	6
2.	Second language	4
3.	Core1-I	4
4.	Core2-I	4
5.	Core3-I	4
6.	Core1-lab I	3
7.	Core2-lab I	3
8.	Core3-lab I	3
9.	Foundation course	3
10.	Computer skills	2
	Total	36

Second year:

S.no.	Subject	Hrs per week
1.	English language including communication skills	6
2.	Second language	4
3.	Core1-II	4
4.	Core2-II	4
5.	Core3-II	4
6.	Core1-lab II	3
7.	Core2-lab II	3
8.	Core3-lab II	3
9.	Environmental studies	4
10.	Computer skills	2
	Total	37

Third year:

S.no.	Subject	Hrs per week
1.	Core1-III	3
2.	Core1-IV	3
3.	Core2-III	3
4.	Core2-IV	3
5.	Core3-III	3
6.	Core3-IV	3
7.	Core1-lab III	3
8.	Core1-lab IV	3
9.	Core2-lab III	3
10.	Core2-lab IV	3
11.	Core3-lab III	3
12.	Core3-lab IV	3
13.	Foundation course	3
	Total	39

STRUCTURE - CURRICULUM
FOR BOTANY IN UNDERGRADUATE DEGREE PROGRAMME

YEAR	PAPER No.	TITLE	WEEKLY TEACHING Hrs.	TOTAL TEACHING Hrs.
FIRST	THEORY PAPER - I	Microbial Diversity, Cryptogams and Gymnosperms	4	120
	PRACTICAL - I	Microbial Diversity, Cryptogams and Gymnosperms (Laboratory exercises related to the syllabus included in Theory Paper – I)	3	90
SECOND	THEORY PAPER - II	Anatomy, Embryology, Taxonomy and Medicinal Botany	4	120
	PRACTICAL - II	Anatomy, Embryology, Taxonomy and Medicinal Botany (Laboratory exercises related to the syllabus included in Theory Paper – II)	3	90
THIRD	THEORY PAPER - III	Cell Biology, Genetics, Ecology and Biodiversity	3	90
	PRACTICAL - III	Cell Biology, Genetics, Ecology and Biodiversity (Laboratory exercises related to the syllabus included in Theory Paper – III)	3	90
	THEORY PAPER - IV	Physiology, Tissue Culture, Biotechnology, Seed Technology and Horticulture	3	90
	PRACTICAL - IV	Physiology, Tissue Culture, Biotechnology, Seed Technology and Horticulture (Laboratory exercises related to the syllabus included in Theory Paper – IV)	3	90

ANDHRA UNIVERSITY
BOTANY SYLLABUS FOR THE ADMITTED BATCH OF 2008-09
Paper - I: Microbial Diversity, Cryptogams and Gymnosperms
 (Total Hours of Teaching: 120 @ 4 h / Week)

- Unit - I: Evolution of Life and Diversity of Microbes (30 h)**
1. Origin and evolution of Life - an outline. (2 h)
 2. **Viruses:** Structure, replication and transmission; plant diseases caused by viruses and their control. (8 h)
 3. **Bacteria:** Structure, nutrition, reproduction and economic importance. An outline of Plant diseases of important crop plants caused by bacteria and their control. (8 h)
 4. **Cyanobacteria:** General Account of Cell Structure, thallus organisation and their prospecting (uses), Biofertilizers (8 h)
- Unit - II: Algae and Fungi (32 h)**
5. **Algae:** General account, thallus organisation, structure, reproduction, classification and economic importance. (4 h)
 6. Structure, reproduction, life history and systematic position of *Oedogonium*, *Coleochaete*, *Chara*, *Ectocarpus* and *Polysiphonia*. (12 h)
 7. **Fungi:** General characters, classification and economic importance. (3 h)
 8. Structure, reproduction and life history of *Albugo*, *Saccharomyces*, *Penicillium*, *Puccinia*, *Alternaria*,. General account of plant diseases caused by Fungi and their control. (10 h)
 9. **Lichens:** Structure and reproduction; ecological and economic importance. (3 h)
- Unit - III: Bryophyta and Pteridophyta (32 h)**
10. **Bryophytes:** General characters, classification and alternation of generations. (3 h)
 11. Structure, reproduction, life history and systematic position of *Marchantia*, *Anthoceros* and *Polytrichum*. Evolution of Sporophyte in Bryophytes. (10 h)
 12. **Pteridophytes:** General characters, classification, alternation of generations and evolution of sporophyte. (5 h)
 13. Structure, reproduction, life history and systematic position of *Rhynia*, *Lycopodium*, *Equisetum* and *Marsilea*. (12 h)
 14. Evolution of stele, heterospory and seed habit in Pteridophytes. (2 h)
- Unit - IV: Gymnosperms and Palaeobotany (26 h)**
15. **Gymnosperms:** General characters, structure, reproduction and classification. (4 h)
 16. Morphology of vegetative and reproductive parts, systemic position, life history of *Pinus* and *Gnetum* (8 h)
 17. **Palaeobotany:** Introduction, Fossils and fossilization; Geological time scale; Importance of fossils. (6 h)
 18. Bennettitales: General account (4 h)

Suggested Readings:

- Alexopolous, J. and W. M. Charles. 1988. Introduction to Mycology. Wiley Eastern, New Delhi.
- Mckane, L. and K. Judy. 1996. Microbiology – Essentials and Applications. McGraw Hill, New York.
- Pandey, B. P. 2001. College Botany, Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S. Chand & Company Ltd, New Delhi.
- Pandey, B. P. 2006. College Botany, Vol. II: Pteridophyta, Gymnosperms and Paleobotany. S. Chand & Company Ltd, New Delhi.
- Pandey, B. P. 2007. Botany for Degree Students: Diversity of Microbes, Cryptogams, Cell Biology and Genetics. S. Chand & Company Ltd, New Delhi.
- Sambamurthy, A. V. S. S. 2006. A Textbook of Plant Pathology. I. K. International Pvt. Ltd., New Delhi.
- Sambamurthy, A. V. S. S. 2006. A Textbook of Algae. I. K. International Pvt. Ltd., New Delhi.
- Sharma, O. P. 1992. Textbook of Thallophyta. McGraw Hill Publishing Co., New Delhi.
- Sporne, K. R. 1965. Morphology of Gymnosperms. Hutchinson Co., Ltd., London.
- Thakur, A. K. and S. K. Bassi. 2008. A Textbook of Botany: Diversity of Microbes and Cryptogams. S. Chand & Company Ltd, New Delhi.
- Vashishta, P. C., A. K. Sinha and Anil Kumar. 2006. Botany - Pteridophyta (Vascular Cryptogams). S. Chand & Company Ltd, New Delhi.
- Vashishta, B. R., A. K. Sinha and V. P. Singh. 2008. Botany for Degree Students: Algae. S. Chand & Company Ltd, New Delhi.
- Vashishta, B. R., A. K. Sinha and Adarsha Kumar. 2008. Botany for Degree Students: Bryophyta. S. Chand & Company Ltd, New Delhi.
- Vashishta, P. C., A. K. Sinha and Anil Kumar. 2006. Botany for Degree Students: Gymnosperms. S. Chand & Company Ltd, New Delhi.
- Vashishta, B. R. 1990. Botany for Degree Students: Fungi, S. Chand & Company Ltd, New Delhi.
- Watson, E. V. 1974. The structure and life of Bryophytes, B. I. Publications, New Delhi.

Practical - I: Microbial Diversity, Cryptogams and Gymnosperms

(Total Hours of Laboratory Exercises: 90 @ 3 h / Week in 30 Sessions)

Suggested Laboratory Exercises:

- 1 Knowledge of equipment used in Microbiology: Spirit lamp, Inoculation loop, Hot air oven, Autoclave / Pressure cooker, Laminar air flow / Inoculation chamber, Incubator, etc. (3 h)
- 2 Preparation of solid and liquid media for culturing of microbes (Demonstration) (9 h)
- 3 Study of viruses and bacteria using electron micrographs (photographs). (3 h)
- 4 Gram staining of Bacteria (3 h)
- 5 Study of symptoms of plant diseases caused by viruses and bacteria:
 - Viruses:** Tobacco mosaic virus, Bunchy top of banana, Yellow vein clearing of bhendi, Leaf curl of papaya (3 h)
 - Bacteria:** Citrus canker, Leaf blight of Rice, Angular leaf spot of cotton. (3 h)
6. Vegetative and reproductive structures of the following taxa:
 - Algae:** *Oscillatoria*, *Nostoc*, *Scytovene*, *Oedogonium*, *Coleochaete*, Chara, *Ectocarpus* and *Polysiphonia*. (6 h)
 - Fungi:** *Albugo*, *Saccharomyces*, *Penicillium*, *Puccinia* and *Alternaria*. (6 h)
7. Section cutting of diseased material infected by Fungi and identification of pathogens as per theory syllabus. (6 h)
8. **Lichens:** Different types of thalli and their external morphology (3 h)
9. Morphology (vegetative and reproductive structures) and anatomy of the following taxa:
 - Bryophytes:** *Marchantia*, *Anthoceros* and *Polytrichum*. (9 h)
 - Pteridophytes:** *Lycopodium*, *Equisetum* and *Marsilea*. (12 h)
 - Gymnosperms:** *Pinus* and *Gnetum*. (6 h)
10. Fossil forms using permanent slides / photographs: *Rhynia* and *Cycadeoidea* (3 h)
11. Symptoms of plant diseases caused by Fungi and mycoplasma: Tikka disease of Groundnut, Late blight of Potato, Ergot of Bajra, Whip smut of Sugarcane, Wheat rust, Brown spot of Rice, Rice (Paddy) blast, Head smut of Sorghum, Little leaf disease of Brinjal (3 h)
12. Enumeration and examination of important microbial, fungal and algal products:
 - Biofertilizers, protein capsules, antibiotics, mushrooms, SCP, Agar-agar etc. (6 h)
13. Field visits to places of algal / microbial / fungal interest (e.g. Mushroom cultivation, water bodies) (6 h)

ANDHRA UNIVERSITY
BOTANY SYLLABUS FOR THE ACADEMIC YEAR -2009-10
Paper - II: Anatomy, Embryology, Taxonomy and Medicinal Botany
 (Total Hours of Teaching: 120 @ 4 h / Week)

Unit - I: Anatomy**(30 h)**

1. **Meristems:** Types, histological organisation of shoot and root apices and theories. (4 h)
2. **Tissues and Tissue Systems:** Simple and complex. (6 h)
3. **Leaf:** Ontogeny, diversity of internal structure; stomata and epidermal outgrowths. (6 h)
4. **Stem and root: Vascular cambium -** Formation and function. Anamalous secondary growth-General account. Stem - *Achyranthes, Boerhavia, Bignonia, Dracaena*;
Root – *Beta* (8 h)
5. **Wood structure:** General account. Study of local timbers – Teak (*Tectona grandis*),
Rosewood, (*Albergia latefolia*), Red sanders, (*Pterocarpus santalinus*) Nallamaddi
(*Terminalia tomentosa* (T. *alata*)), Yegisa (*Pterocarpus marsupium*) and Neem
(*Azadirachta indica*). (6 h)

Unit - II: Embryology**(24 h)**

6. Introduction: History and importance of Embryology.
Anther structure, Microsporogenesis and development of male gametophyte. (5 h)
7. Ovule structure and types; Megasporogenesis; types and development of female gametophyte. (6 h)
8. Pollination - Types; Pollen - pistil interaction. Fertilization. (4 h)
9. Endosperm - Development and types. Embryo - development and types; Polyembryony and Apomixis - an outline. (5 h)
10. Palynology: Principles and applications. (4 h)

Unit - III: Taxonomy**(36 h)**

11. Introduction: Principles of plant systematics, Systematics vs Taxonomy, Types of classification: Artificial, Natural and Phylogenetic. (4 h)
12. Systems of classification: Salient features and comparative account of Bentham & Hooker and Engler & Prantle. An introduction to Angiosperm Phylogeny Group (APG). (6 h)
13. Current concepts in Angiosperm Taxonomy: Embryology in relation to taxonomy, Cytotaxonomy, Chemotaxonomy and Numerical Taxonomy. (4 h)
14. Nomenclature and Taxonomic resources: An introduction to ICBN, Vienna code - a brief account. Herbarium: Concept, techniques and applications. (6 h)
15. Systematic study and economic importance of plants belong to the following families:
Annonaceae, Capparaceae, Rutaceae, Fabaceae (Faboideae/papilionoideae, Caesalpinioideae, Mimosoideae), Cucurbitaceae, Apiaceae, Asteraceae, Asclepiadaceae, Lamiaceae, Amaranthaceae, Euphorbiaceae, Orchidaceae and Poaceae. (16h)

Unit - IV: Medicinal Botany**(30 h)**

16. Ethnomedicine: Scope, interdisciplinary nature, distinction of Ethnomedicine from Folklore medicine. Outlines of Ayurveda, Sidda, Unani and Homeopathic systems of traditional medicine. Role of AYUSH, NMPB, CIMAP and CDRI. (8 h)
17. Plants in primary health care: Common medicinal plants – Tinpateega (*Tinospora cordifolia*), tulasi (*Oscimum sanctum*), pippallu (*Piper longum*), Karaka (*Terminalia chebula*), Kalabanda (*Aloe vera*), Turmeric (*Curcuma longa*). (4 h)
18. Traditional medicine vs Modern medicine: Study of select plant examples used in traditional medicine as resource (active principles, structure, usage and pharmacological action) of modern medicine: Aswagandha (*Withania somnifera*), Sarpagandha (*Rauwolfia serpentina*), Nela usiri (*Phyllanthus amarus*), Amla (*Phyllanthus emblica*) and

Brahmi (*Bacopa monnieri*) Monera .

(6 h)

19. Pharmacognosy: Introduction and scope. Adulteration of plant crude drugs and methods of identification - some examples. Indian Pharmacopoeia. (6 h)
- Evaluation of crude drugs. (6 h)

Suggested Readings:

- Bhattacharya et. al. 2007. A textbook of Palynology, Central, New Delhi.
- Bhojwani, S. S. and S. P. Bhatnagar. 2000. The Embryology of Angiosperms (4th Ed.), Vikas Publishing House, Delhi.
- Davis, P. H. and V. H. Heywood. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd, London.
- Esau, K. 1971. Anatomy of Seed Plants. John Wiley and Son, USA.
- Heywood, V. H. 1965 . Plant Taxonomy. ELBS , London.
- Heywood, V. H. and D. M. Moore (Eds). 1984. Current Concepts in Plant Taxonomy. Academic Press, London.
- Jain, S. K. and V. Mudgal. 1999. A Handbook of Ethnobotany. Bishen Singh Mahendra Pal Singh, Dehradun.
- Jeffrey, C. 1982. An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge. London.
- Johri, B. M. 1984. Embryology of Angiosperms. Springer-Verleg, Berlin.
- Joshi, S. G. 2000. Medicinal Plants. Oxford and IBH, New Delhi.
- Kapil, R. P. 1986. Pollination Biology. Inter India Publishers, New Delhi.
- Kokate, C. and Gokeale- Pharmacognacy- Nirali Prakashan, NewDelhi.
- Lad, V. 1984. Ayurveda – The Science of Self-healing. Motilal Banarasidass, New Delhi.
- Lewis, W. H. and M. P. F. Elwin Lewis. 1976. Medical Botany. Plants Affecting Man's Health. A Wiley Inter science Publication. John Wiley and Sons, New York.
- Maheswari, P. 1971. An Introduction to Embryology of Angiosperms. McGraw Hill Book Co., London.

Pandey, B. P. 2007. Botany for Degree Students: Diversity of Seed Plants and their Systematics, Structure, Development and Reproduction in Flowering Plants. S. Chand & Company Ltd, New Delhi.

Rastogi, R. R. and B. N. Mehrotra. 1993. Compendium of Indian Medicinal Plants. Vol. I & Vol. II. CSIR, Publication and Information Directorate, New Delhi.

Sivarajan, V. V. and I. Balasubramaniyan. 1994. Ayurvedic Drugs and their Plant Sources. Oxford and IBH, New Delhi.

Stace, C. A. 1989. Plant Taxonomy and Biostatistics (2nd Ed.). Edward Arnold, London.

Singh, G. 1999. Plant Systematics: Theory and Practice. Oxford and IBH, New Delhi.

Practical - II: Anatomy, Embryology, Taxonomy and Medicinal Botany

(Total Hours of Laboratory Exercises: 90 @ 3 h / Week in 30 Sessions)

Suggested Laboratory Exercises:

1. Demonstration of double staining technique. (3 h)
2. Tissue organization in root and shoot apices using permanent slides (3 h)
3. Preparation of double staining slides
Primary structure: Root - *Cicer, Canna*; Stem – *Tridax, Sorghum* (6 h)
Secondary structure: Root – *Tridax* sp.; Stem – *Pongamia* (3 h)
Anomalous secondary structure: Examples as given in theory syllabus. (6 h)
4. Stomatal types using epidermal peels. (3 h)
5. Microscopic study of wood in T.S., T.L.S. and R.L.S. (6 h)
6. Structure of anther and microsporogenesis using permanent slides. (3 h)
7. Structure of pollen grains using whole mounts (*Catharanthus, Hibiscus, Acassia, Grass*). (3 h)
8. Pollen viability test using *in-vitro* germination (*Catharanthus*). (3 h)
9. Study of ovule types and developmental stages of embryo sac. (3 h)
10. Structure of endosperm (nuclear and cellular); Developmental stages of dicot and monocot Embryos using permanent slides. (3 h)
11. Isolation and mounting of embryo (using *Symopsis / Senna / Crotalaria*) (3 h)
12. Systematic study of locally available plants belonging to the families prescribed in theory syllabus (Minimum of one plant representative for each family) (18 h)
13. Demonstration of herbarium techniques. (3 h)

14. Local field visits to study the vegetation and flora. (6 h)
15. Detailed morphological and anatomical study of medicinally important part(s) of locally available plants (a minimum 10 plants) used in traditional medicine. (12 h)
16. Field visits to identify and collect ethno medicinal plants used by local tribes/folklore. (3 h)
17. Preparation and submission of 25 herbarium specimens for evaluation during the practical examination.

Paper – III: Cell Biology, Genetics, Ecology and Biodiversity

(Total Hours of Teaching: 90 @ 3 h / Week)

Unit - I: Cell Biology (22 h)

1. Plant cell envelopes: Ultra structure of cell wall, molecular organisation of cell membranes. (3 h)
2. Nucleus: Ultrastructure, Nucleic acids - Structure and replication of DNA; types and functions of RNA. (6 h)
3. Chromosomes: Morphology, organisation of DNA in a chromosome, Euchromatin and Heterochromatin. Karyotype. (6 h)
4. Cell division: Cell cycle and its regulation; mitosis, meiosis and their significance. (5 h)

Unit - II: Genetics (22 h)

6. Mendelism: Laws of inheritance. Genetic interactions - Epistasis, complementary, supplementary and inhibitory genes. (4 h)
7. Linkage and crossing over: A brief account, construction of genetic maps - 2 point and 3 point test cross data. (4 h)
8. Mutations: Chromosomal aberrations - structural and numerical changes; Gene mutations, transposable elements. (5 h)
9. Gene Expression: Organisation of gene, transcription, translation, mechanism and regulation of gene expression in prokaryotes (Lac. and Trp Operons). (7 h)
10. Extra nuclear genome: Mitochondrial and plastid DNA, plasmids. (2 h)

Unit - III: Ecology (25 h)

11. Concept and components of Ecosystem. Energy flow, food chains, food webs, ecological pyramids, biogeochemical cycles - Carbon, Nitrogen, Phosphorus (7 h)
12. Plants and environment: Ecological factors - Climatic (light and temperature), edaphic and biotic. Ecological adaptations of plants. (8 h)
13. Population ecology: Natality, mortality, growth curves, ecotypes, ecads. (3 h)
14. Community ecology: Frequency, density, cover, life forms, biological spectrum, ecological succession (Hydrosere, Xerosere). (5 h)
15. Production ecology: Concepts of productivity, GPP, NPP, CR (Community Respiration) and secondary production, P/R ratio and Ecosystems. (2 h)

Unit - IV: Biodiversity and Conservation

(21 h)

16. Biodiversity: Concepts, Convention on Biodiversity - Earth Summit. Types of biodiversity. (4 h)
17. Levels, threats and value of Biodiversity. (4 h)
18. Hot spots of India – Endemism, North Eastern Himalayas, Western Ghats. (4 h)
19. Agro-biodiversity: Vavilov centres of crop plants. (3 h)
20. Principles of conservation: IUCN threat-categories, RED data book - threatened & endangered plants of India. Role of organisations in the conservation of Biodiversity - IUCN, UNEP, WWF, NBPGR, NBD. (6 h)

Suggested Readings:

- Bharucha, E. 2005. Textbook of Environmental Studies for Undergraduate Courses. Universities Press (India) Private Limited, Hyderabad.
- Fukui, K. and S. Nakayama. 1996. Plant Chromosomes: Laboratory Methods. CRC Press, Boca Raton, Florida.
- Harris, N. and K. J. Oparka. 1994. Plant Cell Biology: A Practical Approach. IRL Press at University Press, Oxford. UK.
- Khitoliya, R. K. 2007. Environmental Pollution – Management and Control for Sustainable Development. S. Chand & Company Ltd., New Delhi.
- Kormondye, E. 1989. Concepts of Ecology (3rd Ed.). Printice Hall of India, New Delhi
- Kothari, A. 1997. Understanding Biodiversity: Life, Sustainability and Equity: Tracts for the Times. 11. Orient Longman Ltd., New Delhi.
- Michael, S. 1996. Ecology. Oxford University Press, London.
- Mishra. D. D. 2008. Fundamental Concepts in Environmental Studies. S. Chand & Company Ltd., New Delhi.
- Odum, E. P. 1983. Basics of Ecology. Saunder's International Students Edition, Philadelphia.
- Pandey, B. P. 2007. Botany for Degree Students: Diversity of Microbes, Coptogams, Cell Biology and Genetics. S. Chand & Company Ltd., New Delhi.
- Sharma, P. D. 1989. Elements of Ecology. Rastogi Publications, Meerut.
- Sharma, A. K. and A. Sharma. 1999. Plant Chromosomes: Analysis, Manipulation and Engineering. Harwood Academic Publishers, Australia.
- Shukla, R. S. and P. S. Chandel. 2007. Cytogenetics, Evolution, Biostatistics and Plant Breeding. S. Chand & Company Ltd., New Delhi.
- Singh, H. R. 2005. Environmental Biology. S. Chand & Company Ltd., New Delhi.
- Snustad, D. P. and M. J. Simmons. 2000. Principles of Genetics. John Wiley & Sons, Inc., U S A
- Strickberger, M. W. 1990. Genetics (3rd Ed.). Macmillan Publishing Company.
- Verma, P. S. and V. K. Agrawal. 2004. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Company Ltd., New Delhi.
- Verma, P. S. and V. K. Agrawal. 2006. Genetics. S. Chand & Company Ltd., New Delhi

ANDHRA UNIVERSITY
BOTANY SYLLABUS FOR THE ACADEMIC YEAR -2010-11
Practical - III: Cell Biology, Genetics, Ecology and Biodiversity

(Total Hours of Laboratory Exercises: 90 @ 3 h / Week in 30 Sessions)

Suggested Laboratory Exercises:

1. Demonstration of cytochemical methods: Fixation of plant material and nuclear staining for mitotic and meiotic studies. (6 h)
2. Study of various stages of mitosis using cytological preparation of Onion root tips (6 h)
3. Study of various stages of meiosis using cytological preparation of Onion flower buds (12 h)
4. Karyotype study using cytological preparation of dividing root tip cells of Onion / photographs / permanent slides (3 h)
5. Solving genetic problems related to monohybrid, dihybrid ratio and interaction of genes (minimum of six problems in each topic). (15 h)
6. Construction of linkage maps; two point test cross. (6h)
7. Knowledge of ecological instruments: Working principles and applications of Hygrometer, rain gauge, anemometer, altimeter, light meter, wet and dry bulb thermometer (with the help of Equipment / diagrams/ photographs). (6 h)
8. Determination of soil texture (composition of clay, sand silt etc.) and p^H . (3 h)
9. Study of morphological and anatomical characteristics of plant communities using locally available plant species: Hydrophytes (*Eichhornia*, *Hidrilla*, *Pistia*, *Nymphaea*, *Vallisneria*), Xerophytes (*Asperagus*, *Opuntia*, *Euphorbia antiquorum*) and Halophytes (*Rhizophora*, *Avecenia*). (9 h)
11. Detailed study on flora of a local fresh water or aquaculture pond. (6 h)
12. Geographical spotting of certain endemic and endangered plant species of AP. (3 h)
13. Minimum of two field visits to local areas of ecological / conservation of biodiversity importance (Sacred grove / Reserved forest / Botanical garden / Zoo Park / Lake etc.). (6 h)

ANDHRA UNIVERSITY
BOTANY SYLLABUS FOR THE ACADEMIC YEAR -2010-11
Paper - IV: Physiology, Tissue Culture, Biotechnology,
Seed Technology and Horticulture
(Total Hours of Teaching: 90 @ 3 h / Week)

Unit - I: Physiology (Part A) (24 h)

1. *Water Relations*: Importance of water to plant life, physical properties of water, diffusion, imbibition, osmosis; water, osmotic and pressure potentials; absorption, transport of water, ascent of sap; transpiration; Stomatal structure and movements. (6 h)
2. *Mineral Nutrition*: Essential macro and micro mineral nutrients and their role; symptoms of mineral deficiency; absorption of mineral ions; passive and active processes. (4 h)
3. *Enzymes*: Nomenclature, characteristics, mechanism and regulation of enzyme action, enzyme kinetics, factors regulating enzyme action. (4 h)
4. *Photosynthesis*: Photosynthetic pigments, absorption and action spectra; Red drop and Emerson enhancement effect; concept of two photosystems; mechanism of photosynthetic electron transport and evolution of oxygen; photophosphorylation; Carbon assimilation pathways: C₃, C₄ and CAM; photorespiration. (8 h)
5. *Translocation of organic substances*: Mechanism of phloem transport; source-sink relationships. (2 h)

Unit - II: Physiology (Part B) (24 h)

6. *Respiration*: Aerobic and Anaerobic; Glycolysis, Krebs cycle; electron transport system, mechanism of oxidative phosphorylation, pentose phosphate pathway. (6 h)
7. *Nitrogen Metabolism*: Biological nitrogen fixation, nitrate reduction, ammonia assimilation, amino acid synthesis and protein synthesis. (6 h)
8. *Lipid Metabolism*: Structure and functions of lipids; conversion of lipids to carbohydrates, β -oxidation. (3 h)
9. *Growth and Development*: Definition, phases and kinetics of growth. Physiological effects of phytohormon- auxins, gibberellins, cytokinins, ABA, ethylene and brassinosteroids; Physiology of flowering and photoperiodism, role of phytochrome in flowering. (7 h)
10. *Stress Physiology*: Concept and plant responses to water, salt and temperature stresses. (2 h)

Unit - III: Tissue Culture and Biotechnology**(22 h)**

11. Tissue culture: Introduction, sterilization procedures, culture media - composition and preparation; explants. (4h)
12. Callus culture; cell and protoplast culture, Somatic hybrids and cybrids. (4h)
13. Applications of tissue culture: Production of pathogen free plants and somaclonal variants, production of stress resistance plants, secondary metabolites and synthetic seeds. (4h)
14. Biotechnology: Introduction, history and scope. (3h)
15. rDNA technology: Vectors and gene cloning and transgenic plants. (7h)

Unit - IV: Seed Technology and Horticulture**(20 h)**

16. Seed: Structure and types. Seed dormancy; causes and methods of breaking dormancy. (4 h)
17. Seed storage: Seed banks, factors affecting seed viability, genetic erosion. Seed production technology; seed testing and certification. (4 h)
18. Horticulture techniques: Introduction, Cultivation of ornamental and vegetable crops, Bonsai and landscaping (4 h)
19. Floriculture: Introduction. Importance of green house, polyhouse, mist chamber, shade nets; Micro irrigation systems. Floriculture potential and its trade in India (4 h)
20. Vegetative Propagation of plants: Stem, root and leaf cuttings. Layering and bud grafting. Role of plant growth regulators in horticulture. (4 h)

Suggested Readings:

- Adams, C. R., K. M. Banford and M. P. Early. 1993. Principles of Horticulture. Butterworth Heineman Ltd., London.
- Agrawal, P. K. 1993. Hand Book of Seed Technology. Dept. of Agriculture and Cooperation. National Seed Corporation Ltd., New Delhi
- Balasubramanian, D., C. F. A. Bryce, K. Dharmalingam, J. Green and K. Jayaraman. 2004. Biotechnology. Universities Press (India) Private Limited, Hyderabad.
- Bedell, Y. E. Seed Science and Technology. Indian Forest Species. Allied Publishers Limited. New Delhi.
- Channarayappa. 2007. Molecular Biotechnology – Principles and Practices. Universities Press (India) Private Limited, Hyderabad.
- Chawala, H. S. 2002. Introduction to Plant Biotechnology. Oxford & IBH Publishing Company, New Delhi.
- Dubey, R. C. 2001. A Textbook of Biotechnology. S. Chand & Company Ltd., New Delhi
- Edmond, J. B., T. L. Senn, F. S. Adrews and R. J. Halfacre. 1977. Fundamentals of Horticulture (4th Ed.). Tata McGraw-Hill, New Delhi.
- Gorer, R. 1978. The Growth of Gardens. Faber and Faber Ltd., London.
- Hartman, H. T. and D. E. Kestler. 1976. Plant Propagation: Principles and Practices. Prentice & Hall of India, New Delhi.
- Hopkins, W. G. 1995. Introduction to Plant Physiology. John Wiley & Sons Inc., New York, USA
- Jain, J.L., S. Jain and Nitin Jain. 2008. Fundamentals of Biochemistry. S. Chand & Company Ltd., New Delhi.
- Jha, T.B. and B. Ghosh. 2005. Plant Tissue Culture – Basic and Applied. Universities Press (India) Private Limited, Hyderabad.
- Janick Jules. 1979. Horticultural Science. (3rd Ed.). W. H. Freeman and Co., San Francisco, USA.
- Lewin, B. 1994. Genes V. Oxford University Press., Oxford.
- Lewin, B. 2002. Genes VII. Oxford University Press., Oxford.
- Pandey, B. P. 2007. Botany for Degree Students: Plant Physiology, Biochemistry, Biotechnology, Ecology and Utilization of Plants. S. Chand & Company Ltd., New Delhi.
- Ramawat, K. G. 2008. Plant Biotechnology. S. Chand & Company Ltd., New Delhi.
- Rao, K. M. 1991. A Text Book of Horticulture. McMillan India Ltd, New Delhi.
- Salisbury, F. B. and C. W. Ross. 1992. Plant Physiology. 4th edn. (India Edition), Wordsworth, Thomson Learning Inc., USA.
- Taiz, L. and E. Zeiger. 1998. Plant Physiology (2nd Ed.). Sinauer Associates, Inc., Publishers, Massachusetts, USA.
- Tiwari, G. N. and R. K. Goal. Green House Technology – Fundamentals, Design, Modelling and Application. Narosa Publishing House, New Delhi.

Tunwar, N. S. and S. V. Singh. 1988. Indian Minimum Seed Certification Standards. The Central Seed Certification Board, Govt. of India, New Delhi.

**Practical - IV: Physiology, Tissue Culture, Biotechnology,
Seed Technology and Horticulture**

(Total Hours of Laboratory Exercises: 90 @ 3 h / Week in 30 Sessions)

Suggested Laboratory Exercises:

1. Determination of osmotic potential of vacuolar sap by plasmolytic method using leaves of *Rhoeo / Tradescantia*. (3 h)
2. Determination of rate of transpiration using cobalt chloride method/Ganong's photometer. (6 h)
3. Determination of stomatal frequency using leaf epidermal peelings/impressions. (3 h)
4. Study of mineral deficiency symptoms using plant material/photographs. (3 h)
5. Determination of catalase activity using potato tubers by titration method. (3 h)
6. Separation of chloroplast pigments using paper chromatography technique. (3 h)
7. Estimation of protein by biuret method. (3 h)
8. Isolation and estimation of DNA. (6 h)
9. Testing of seed viability using 2, 3, 5-triphenyl tetrazolium chloride (TTC). (3 h)
10. Study of non-dormant seed germination: Breaking of seed dormancy caused by hard seed coat using scarification technique. (3 h)
11. Demonstration of seed dressing using fungicide to control diseases. (3 h)
12. Demonstration of seed dressing using biofertilizer (*Rhizobium*) to enrich nutrient supply. (3 h)
13. Study on tools/equipment used in horticulture: Rake, hoe, spade, trowel, digger, pick-axe, shade net, glass house and mist chamber (6 h)
14. Demonstration of vegetative plant propagation: Rooting of cuttings – Leaf and Stem; layering; stem, bud and wedge grafting (6 h)
15. Study on the application of plant growth regulator (IBA) for rooting of cuttings using ornamental plants (6 h)
16. Knowledge of instruments and facilities used in plant tissue culture Using equipment / photographs) (6 h)
17. Demonstration of micropropagation using explants like axillary buds and shoot meristems. (6 h)
18. Study of protocols and photographs/charts related to plant bio-technology: Isolation of nuclear and plasmid DNA, separation of DNA by gel electrophoresis (6 h)

19. Study of biotechnology products: Samples of antibiotics, vaccines, biofertilizers, single cell protein, cosmetics; photographs of transgenic plants, multiple shoots and Artificial / synthetic seeds (6 h)
20. Study visits to places of horticultural and biotechnological interest - Commercial nurseries/ Botanical gardens; Biotechnology R & D laboratories/Industries. (6 h)

ADD ON COURSE: SELF STUDY PRACTICAL PROJECT***Suggested Titles Related to First Year Syllabus:***

1. Cultivation and processing of edible mushrooms.
2. Cultivation of *Spirulina*.
3. Production of biofertilizers.
4. Cyanobacteria as biofertilizer.
5. Plant diseases caused by viruses and their control.
6. Plant diseases caused by bacteria and their control.
7. Plant diseases caused by fungi and their control.
8. Economic importance of algae of a region.
9. Macrofungi of a local forest and their importance.
10. Collection of lichens and their habitats.
11. Collection of bryophytes of a habitat and their identification.
12. Preservation of pteridophytes of the region through herbarium.

Suggested Titles Related to Second Year Syllabus:

13. Collection and preservation of local timbers with diagnostic features and names.
14. Morphological study or preparation of pollen (atlas) of the region.
15. Survey of economic plants of the region.
16. Collection and documentation of fiber and dye-yielding plants of the region.
17. Collection and documentation of resin and gum-yielding plants of the region.
18. Folklore medicinal plants of the region.
19. Ethnomedicinal plants of the region.
20. Ethnobotanical plants of a local tribe.
21. Common medicinal plants of a locality and their uses.
22. Floristic study of a local area.
23. Plant based tribal medicines.
24. Propagation of medicinally important plants of a locality.
25. Traditional usage of plants in primary health care practices.
26. Taxonomic validation of locally used plant drugs in traditional medicine.
27. Common adulterants of edibles.
28. Phytoinsecticides / Biopesticides.

Suggested Titles Related to Third Year Syllabus:

29. Prospecting of plants for alternative (non-conventional) energy sources.
30. Phytoremediation of polluted soils/water.
31. Biodiversity of a habitat.
32. Biodiversity of a selected sacred grove.
33. Study of a natural ecosystem around.
34. Explore the food chain in the local natural ecosystem.
35. Agrobiodiversity of a region.
36. Threatened plants of a region.
37. Survey of root-nodule forming plants of a region.
38. Invasive plants of a region.
39. Identification of C₄ and CAM plants of a region.
40. Mineral deficiency of selected element in plants and its control.
41. Breaking of seed dormancy (of a tree species).
42. Seed variability of commercially available seeds.
43. Application of antitranspirants.
44. Factors affecting photosynthesis (light, CO₂, temperature).
45. Effects of water stress on growth and development of plants.
46. Micropropagation of endangered or threatened medicinal plants.
47. Production of synthetic seeds.
48. Application of plant growth regulators for rooting of stem cuttings.
49. Prolongation of self-life of vegetables/edible fruits/flowers.
50. Applications of plant growth regulators in Horticulture
51. Prolongation of self life of vegetables / edible fruits / flowers
52. Mineral deficiency of selected element in plants and its control
53. Seed quality, storage and viability of selected crop plant.
54. Colonial propagation of Horticultural plants

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 Model Question paper of practicals
 Botany practical paper –II
 At the end of II year

Anatomy, Embryology, Taxonomy and Medicinal Botany

3 Hors

Marks – 50

- I. Describe the given specimen “A” in technical terms 10
- Draw the diagrams of Twig. L.S. of flower. T.S. of ovary Floral Diagram and Floral formula
 Technical description-5, Twig-1 L.S. of Flower-1
 T.S. of ovary-1/2 Floral Diagram 1 ½, Floral formula-1
- II. Derive the given specimen “B” up to family level with reasons. 3
- III. Take the section of given material “C” stain and mount. Leave the preparation for valuation.
 Identify giving reasons. Draw neat labeled diagram.
 C-Anomalous secondary growth from stem 10
 Slide preparation – 5 Reasons – 2
 Identification -- 1 Diagram – 2
- IV. Identify and writes notes an “D” & “E” 3 x 2 = 6
 (Identification + Diagram + Embryology Notes)
- V. Write the Botanical name, Family and Medicinal important of F & G 3 x 2=6
- VI. Write the Herbarium technique in brief and identify the herbarium sheets H & I
 2 + 3 = 5
 h. technique – 2
 H. Sheet 1 ½ x2=3
- VII. Record + Herbarium + Field notes + Viva
 5 2 1 2 10

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Model Question paper of Practicals

Botany paper – I

Practicals: At the end of I year

Microbiology, Algae, Fungi, Bryophyta, Pteridophyta, Gymnsperms & Palaeobotany

Time 3 hours	50 Marks
I. Identity the two algal Members in A	2x2=4
II. Take the section of given material “B”	
Stain and mount, Leave the preparation for valuation Identify giving reasons.	
Draw neat labeled diagram (Fungi/Bryophyta)	10
Side preparation – 5, Reasons – 2	
Identification --1, Diagram –2	
III. Take the section of given material “C” stain and mount, Leave the preparation for valuation	
Identify giving reasons. Draw neat labeled diagram (Pteridophyta/Gymnosperms)	10
IV. Identity and write notes on ‘D’ ‘E’ ‘F’ ‘G’ (SPTTERS)	8
‘D’ Viral/Bacterial/Fungal diseases	2x4=8
‘E’ Bryophyta/Pteridophyta – Speciman	
NOTE: If the section cutting is from Bryophyta, specimen must be from	
Pteridophyta or Vice-versa	
F-Gymnosperm – specimen	
G- Fossil – Photograph/slide	
(Diagrams not necessary)	
V. Identify and write notes on H,I,J&K, (Slides)	2x4=8
H – Fungi	
I – Bryophyta	
J – Pteridophyta	
K – Gymnosperm	
VI. Record + Viva	8+2=10

Total	50
