



BOTANY (UG)
III and IV Semester syllabus
(According to National Education Policy (NEP)- 2020)

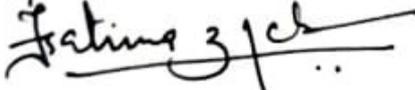
Proceedings of the BOS in Botany (UG) Meeting

Held on 25-11-2022, at Pareeksha Bhavan Tumkur university Tumkur.

Chairman welcomed the members of BOS(UG) to the meeting and the agenda was placed before the board members for discussion. Discussions were held and concluded as follows:

1. 3rd and 4th semester syllabus Discussed and approved.
2. 3rd and 4th semester practical question papers and scheme of valuation are prepared and approved.
3. Open elective course syllabus are prepared and approved .

Members present:

1.  G. Geethanjali. M.S.
2.  M. Vasanth Kumar
3.  S. Chidambaram Murthy S. Chidambaram Murthy
4.  Dr. FATIMA TU-ZAHORA-JABEEN

Members absent: NIL


CHIDANANDASWAMY B. M.
Chairman
BOS in Botany (UG)
Tumkur University, TUMKUR.

II B Sc -SEMESTER - III

BOTANY - Discipline specific core course (BOTDSC03)

Title of the course: PLANT ANATOMY AND DEVELOPMENT BIOLOGY

Course No	Type of course	Theory/practical	Credits	Instruction hours per week	Total number of hours / sem.	Duration of Exam	Formative assessment marks	Summative assessment marks	Total marks
3.1	BOTDSC03	Theory	04	04hrs	56hrs	2hrs	40	60	100

Course Outcomes: On completion of this course, the students will be able to:

1. Observation of variations that exist in internal structure of various parts of a plant and as well as among different plant groups in support for the evolutionary concept.
2. Skill development for the proper description of internal structure using botanical terms, their identification and further classification
3. Induction of the enthusiasm on internal structure of locally available plants.
4. Understanding various levels of organization in the plant body with an outlook in the relationship between the structure and function through comparative studies.
5. Observation and classification of the floral variations from the premises of college and house.
6. Understanding the various reproductive methods sub-stages in the life cycle of plants
7. Observation and classification of the embryological variations in angiosperms.
8. Enthusiasm to understand evolution based on the variations in reproduction among plants

UNIT	COURSE CONTENT	HOURS
I	<p>PLANT HISTOLOGY Introduction, objective and scope of Plant Anatomy, Plant cell structure – nature of plant cell wall.</p> <p>Tissue and tissue systems - meristematic tissue, Classification of meristem: Based on origin (pro, primary and secondary meristem), based on position (apical, intercalary and lateral). Organization of shoot apex (Apical cell theory, Histogen theory Tunica-Corpus theory , cytohistological zonation). Permanent tissues and Secretary cells.</p>	14Hrs
II	<p>PLANT ANATOMY Tissue systems, Types of vascular bundles and Vascular cambium. Structure of Dicot root: primary and secondary structures (Tridax/Sunflower), Structure of monocot root (Maize). Structure of Dicot stem: Primary and secondary structures (Tridax/Sunflower), Structure of Monocot stem (Maize), Structure of Dicot leaf: primary structure (Tridax/Sunflower), primary structure of Monocot leaf (Maize). Stomatal types. Anomalous secondary growth: Aristolochia, Boerhaavia (dicot stem) Dracaena (monocot stem)</p>	14Hrs

III	<p>DEVELOPMENT BIOLOGY</p> <p>Morphogenesis and Differentiation: Differentiation and cell polarity in unicellular (<i>Acetabularia</i>) and multicellular system (root hair and stomata formation)</p> <p>Organogenesis: Differentiation of root, stem, leaf and axillary buds. Mechanism of leaf primordium initiation and development .</p> <p>Structure and function of root apical meristem (RAM): Root cap, quiescent Centre and origin of lateral roots. Transition from vegetative apex into reproductive apex</p> <p>Developmental patterns at flowering apex: ABC model specification of floral organs.</p>	14Hrs
IV	<p>REPRODUCTIVE BIOLOGY</p> <p>Introduction, Scope and contributions of Indian embryologists: P. Maheswari and B G L Swamy.</p> <p>Microsporangium: Development and structure of mature anther, Anther wall layers, Tapetum - types, structure and functions and sporogenous tissue.</p> <p>Microsporogenesis: Microspore mother cells, microspore tetrads, Pollinia.</p> <p>Microgametogenesis: Formation of vegetative and generative cells, structure of male gametophyte, pollen embryosa (Neme phenomenon)</p> <p>Megasporangium: Structure of typical angiosperm ovule, types of ovules-anatropous, Orthotropous, Amphitropous, Circinotropous.</p> <p>Megagametogenesis: Types of development of female gametophyte / embryosa: monosporic-<i>Polygonum</i> type, bisporic-<i>Allium</i> type and tetrasporic- <i>Fritillaria</i> type. Structure of mature embryosa.</p> <p>Pollination and fertilization: Structural and functional aspects of pollen, stigma and style. Post pollination events; Current aspects of fertilization and Significance of double fertilization, Post fertilization changes.</p> <p>Endosperm: Types and its biological importance. Free nuclear (<i>Cocos nucifera</i>) cellular (<i>Cucumis</i>), helobial types. Ruminant endosperm.</p> <p>Embryogenesis: Structure and composition of zygote, Dicot (<i>Capsella bursa-pastoris</i>) and Monocot (<i>Najas</i>) embryo development. A general account of seed development.</p>	14Hrs

Text Books for Reference:

1. Bhojwani and Bhatnagar, Introduction to Embryology of Angiosperms –Oxford & IBH Delhi
2. Coutler E. G., 1969. Plant Anatomy – Part I Cells and Tissues – Edward Arnold, London
3. Eames A. J. - Morphology of Angiosperms - Mc Graw Hill, New York.
4. Esau, K. 1990. Plant Anatomy, Wiley Eastern Pvt Ltd New Delhi
5. Fahn, A.1992. Plant Anatomy, Pergamon Press, USA
6. Johri, B.M. l., 1984.Embryology of Angiosperms, Springer-Verlag, Netherlands.
7. Karp G., 1985. Cell Biology; Mc.Graw Hill Company
8. Maheshwari,P 1950. An introduction to the embryology of angiosperms.
9. Nair P. K. K - Pollen Morphology of Angiosperms - Scholar Publishing House,
10. Pandey S.N. 1997, Plant Anatomy and Embryology .A. Chadha, Vikas Publication house
11. Pandey, B. P., 1997. Plant Anatomy, S.Chand and Co. New Delhi
12. Raghavan.V, 2000, Developmental biology of flowering plants. Springer Netherlands
13. Saxena, M. R. – Palynology – A treatise - Oxford & I. B .H., New Delhi.
14. Shivanna, K. R., Pollen biology and biotechnology Oxford & IBH Delhi
15. Vashishta, P.C .,1984. Plant Anatomy – Pradeep Publications – Jalandhar

PRACTICAL
BOTANY- Discipline specific core course- (BOTDSC03P)
Title of the course: PLANT ANATOMY AND DEVELOPMENT BIOLOGY

Course No	Type of course	Theory/ practical	Credits	Instruction hours per week	Total number of hours / sem.	Duration of Exam	Formative assessment marks	Summative assessment marks	Total marks
3.2	BOTDSC03P	Practical	02	04hrs	52hrs	3hrs	25	25	50

LIST OF EXPERIMENT TO BE CONDUCTED

Practical No.1: i). Study of meristem (Permanent slides/ Photographs).
 ii). Study of Simple Tissues (Parenchyma, Collenchyma and Sclerenchyma) and Complex Tissues (xylem and phloem) Maceration technique to study elements of xylem and phloem

Practical No.2: Study of primary structure of dicot root, stem and leaf (Sunflower) and monocot root, stem and leaf (Maize)

Practical No.3: Study of anomalous secondary growth in *Boerhaavia* and *Dracaena*

Practical No.4: Study of trichomes (any three types) and stomata (any three types) with the help of locally available plant materials

Practical No.5: Permanent slides of T.S. of mature anther. Mounting of Pollen grains of Grass and Hibiscus and Pollinia of Calotropis

Practical No.6: Study of Pollen germination (Hanging drop method) and calculate the percentage of pollen germination.

Practical No.7: Permanent slides of types of ovules, types of placentation (Axile, Marginal and Parietal), Sectioning of ovary to study the types of placentation.

Practical No.8: Mounting of embryo: Tridax / Cyamopsis, Mounting of endosperm: Cucumis

Practical No.9: Histochemical localization of proteins/ carbohydrates

Practical No. 10 and 11: Mini project work in groups of 3-5 students, from the following list
 a) Study of pollen morphology of different flowers with respect to shape, colour, aperture etc.
 b) Pollen germination of different pollen grains and calculates percentage of germination.
 c) Calculating percentage of germination of one particular type of pollen grain collected from different localities/ under different conditions
 d) Study of placentation of different flowers.
 e) Any other relevant study related to Anatomy / Embryology.

THIRD SEMESTER PRACTICAL EXAMINATION

Practical Question Paper -III

BOTANY -Discipline specific core course (BOTDSC03P)

Title of the course: PLANT ANATOMY AND DEVELOPMENT BIOLOGY

Time: 3Hours

Max. Marks 25

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|--|------------|
| 1. Identify the slides A, B, C and D with labeled diagrams and reasons. | 4 X 3 = 12 |
| 2. Prepare a temporary safranin slide of E , sketch, label and identify with reasons, leave the preparation for evaluation. | 1 X 4 = 4 |
| 3. Mount the endosperm / embryo of material F . | 1 X 4 = 4 |
| 4. Class record and Submissions. | 3 + 2 = 5 |

Scheme of Evaluation :

1. **A, B, C** and **D** - (2-from Anatomy and 2- from Development biology)

Identification- 1 mark, labeled diagram – 1 mark, reasons- 1 mark

Plant anatomy: parenchyma / collenchyma / sclerenchyma / complex tissues / T.S. of dicot(root, stem, and leaf) /T.S. of Monocot(root, stem and leaf) / T.S. of Boerhaavia stem.

Development biology: T.S. of mature anther / types of Ovules / types of placentation

2. **E** - (Plant anatomy specimen - Tridax stem /Grass stem / Cicer root/ Maize root/ Boerhaavia stem).

Preparation –1mark, identification – 1 mark, sketch and label-1 mark, reasons – 1 mark.

3. **F** - Embryo (Tridax) / Endosperm (Cucumis)

Mounting – 2 marks, labeled diagram-1 mark, reasons – 1 mark

4. Class record – 3marks. Submissions: 2marks-2 permanent slides (1 from Plant anatomy, 1- from Development biology)

II B Sc- SEMESTER- IV

BOTANY- Discipline specific core course -(BOTDSC04)

Title of The Course: ECOLOGY AND CONSERVATION BIOLOGY

Course No.	Type of course	Theory/ practical	Credits	Instruction hours per week	Total number of hours / sem.	Durati on of Exam	Formative assessment marks	Summative assessment marks	Total marks
4.1	BOTDSC04	Theory	04	04hrs	56hrs	2hrs	40	60	100

Course Outcomes: On completion of this course, the students will be able to:

1. Understand core concepts of biotic and abiotic
2. classify the soils on the basis of physical, chemical and biological components
3. Analysis the phytogeography or phytogeographical division of India
4. Evaluate energy sources of ecological system
5. Assess the adaptation of plants in relation to light, temperature, water, wind and fire.
6. Conduct experiments using skills appropriate to subdivisions

UNIT	COURSE CONTENT	HOURS
I	<p>Introduction to Ecology: Definitions, Principles of Ecology, Major Indian Contributions, Scope and importance. Ecological levels of organization.</p> <p>Ecological factors: Climatic factors: light, temperature, precipitation and humidity.</p> <p>Edaphic factors: Soil and its types, soil texture, soil profile, soil formation; physico-chemical properties of soil - mineral particle, soil pH, soil aeration, organic matter, soil humus and soil microorganisms.</p> <p>Topographic Factors: Altitude</p> <p>Ecological groups of plants: Morphological and anatomical adaptations of hydrophytes, xerophytes, epiphytes and halophytes.</p>	14Hrs
II	<p>Ecosystem Ecology: Introduction, types of ecosystems with examples - terrestrial and aquatic, natural and artificial</p> <p>Structure of ecosystem: Biotic and Abiotic components, detailed structure of a pond ecosystem.</p> <p>Ecosystem functions and processes: Food chain(Grazing and detritus), Food web, Ecological pyramids: Pyramid of energy, biomass and number. Principles of energy flow in ecosystem.</p> <p>Bio-geo chemical cycles: Gaseous cycles -carbon and nitrogen, Sedimentary cycle-Phosphorus.</p> <p>Ecological succession: Definition, types- primary and secondary. General stages of succession. Hydrosere and xerosere.</p> <p>Community ecology: community and its characteristics- frequency, density abundance, cover and basal area, phenology, stratifications, life-forms. Concept of Ecotone and Ecotypes.</p> <p>Intra-specific and Inter-specific interactions with examples.</p> <p>Ecological methods and techniques: Methods of sampling plant communities- transects and quadrates. Remote sensing as a tool for vegetation analysis, land use – land cover mapping.</p> <p>Population Ecology: Population and its characteristics – Population</p>	14Hrs

	density, natality, mortality, age distribution, population growth curves and dispersal.	
III	<p>Phytogeography and Environmental issues: Theory of land bridge, theory of continental drift, polar oscillations and glaciations. Centre of origin of plant – Vavilov’s concept, types. Phytogeographical regions of India.</p> <p>Vegetation types of Karnataka – Composition and distribution of evergreen, semi- evergreen, deciduous, scrub, mangroves, shoal forests and grasslands.</p> <p>Pollution: Water pollution: Causes, effect, types; water quality indicators, water quality standards in India, control of water pollution (Waste water treatment).</p> <p>Water pollution disasters – National mission on clean Ganga ,Minimata, Pacific gyre garbage patch, Exxon valdez oil spill.</p> <p>Air pollution: Causes, effect, air quality standards, acid rain, control.</p> <p>Soil pollution: Causes, effect, solid waste management, control measures of soil pollution.</p>	14Hrs
IV	<p>Biodiversity and its conservation</p> <p>Biodiversity: Definition, types of biodiversity - habitat diversity, species diversity and Genetic diversity. SDG’s (Sustainable Development Goals)in biodiversity conservation</p> <p>Values of Biodiversity – Economic and aesthetic value, Medicinal and timber yielding plants. NTFP. Threats to biodiversity.</p> <p>Concept of Biodiversity Hotspots, Biodiversity hot spots of India. Concept of endemism and endemic species. ICUN plant categories with special reference to Karnataka/ Western Ghats.</p> <p>Biodiversity Conservation- Indian forest conservation act, Biodiversity bill (2002).</p> <p>Conservation methods – <i>In-situ</i> and <i>ex-situ</i> methods</p> <p><i>In-situ</i> methods –Biosphere reserves, National parks, Sanctuaries, Sacred grooves.</p> <p><i>Ex-situ</i> methods-Botanical gardens, seedbank, gene bank, pollen bank. cryopreservation.</p>	14Hrs

SUGGESTED REFERENCE BOOKS:

1. Sharma, P.D. 2018. Fundamentals of Ecology. Rastogi Publications.
2. Odum E.P. (1975): Ecology By Holt, Rinert& Winston.
3. Kochhar, P.L. (1975): Plant Ecology. (9th Edn.,) New Delhi, Bombay, Calcutta-226pp.,
4. Kumar, H.D. (1992): Modern Concepts of Ecology ,Vikas Publishing Co., New Delhi
5. Kumar H.D. (2000): Biodiversity & Sustainable Conservation. Oxford & IBH New Delhi.
6. Newman, E.I. (2000): Applied Ecology, Blackwell Scientific Publisher, U.K.
7. Saha T. K., 2017. Ecology and Environmental Biology. Books and Allied Publishers

PRACTICAL
BOTANY -Discipline specific core course- (BOTDSC04P)
Title of the course: Ecology and Conservation Biology

Course No	Type of course	Theory/ practical	Credits	Instruction hours per week	Total number of hours / sem.	Duration of Exam	Formative assessment marks	Summative assessment marks	Total marks
4.2	BOTDSC04P	Practical	02	04hrs	52hrs	3hrs	25	25	50

LIST OF PRACTICAL IN ECOLOGY AND CONSERVATION BIOLOGY

1. Determination of pH of different types of Soils, Determination of soil texture of different soil samples
2. **Study of Ecological instruments** – Wet and Dry thermometer, Altimeter, Hygrometer, Soil, thermometer, Rain Gauge, Barometer, etc
3. **Hydrophytes:** Morphological adaptations in *Pistia*, *Eichhornia*, *Hydrilla*, *Nymphaea* Anatomical adaptations in *Hydrilla*(stem) and *Nymphaea* (petiole).
5. **Xerophytes:** Morphological adaptations in *Asparagus*, *Casuarina*, *Acacia*, *Aloe vera* *Euphorbia tirucalli*. Anatomical adaptations in phylloclade of *Casuarina*
6. **Epiphytes:** Morphological adaptations in *Acampe*, *Bulbophyllum*, *Drynaria*. Anatomical adaptations in epiphytic root of *Acampe*/ *Vanda*
4. **Halophytes:** study of Vivipary, Pneumatophores in mangroves,
7. Study of a pond/forest ecosystem and recording the different biotic and abiotic components
8. Demonstration of different types of vegetation sampling methods – transects and quadrats Determination of Density and frequency.
9. Application of remote sensing to vegetation analysis using satellite imageries
10. Field visits to study different types of local vegetations/ecosystems and the report to be submitted.
11. Determination of water holding capacity of soil samples
12. Determination of Dissolve oxygen in water sample.
13. Determination of Chemical oxygen demand (COD)
14. Estimation of salinity of soil/water samples.

Fourth Semester Practical Examination

Practical Question Paper -IV

BOTANY- Discipline specific core course -(BOTDSC04P)

Title of the course: Ecology and Conservation Biology

Time: 3Hours

Max. Marks 25

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| 1. Identify specimens A, and B .with labeled diagram and write their ecological importance. | 2 X 3 = 6 |
| 2. Identify the slides C and D with labeled diagrams and reasons | 2 X 3 = 6 |
| 3. Estimate the salinity / dissolved oxygen of given water sample E . | 1 X 6 = 6 |
| 4. Comment on F . | 1 X 2 = 2 |
| 5. Class records and Field report | 3+ 2 = 5 |

SCHEME OF EVALUATION:

- A and B - Specimens:** (Hydrilla / Pistia / Eichhornia / Nymphaea / Asparagus / Aloe vera / E.tirukalli / Casuarina / Acampe/ Bulbophyllum / Drynaria. / Vivipary / Pneumatophores)
Identification - 1 mark, labeled diagram – 1 mark, reasons-1 mark
- C and D - Slides:** (T.S. of - Hydrilla stem / Nymphaea petiole / Casuarina phylloclade / Epiphytic root / Pnematophore)
Identification - 1 mark, labeled diagram – 1 mark, reasons - 1 mark
- E - Procedure - 2marks, conduction – 2 marks, calculation – 1mark, result -1 mark)**
- F- (Ecological instrument) - Identification – 1 mark, comment- 1 mark.**
- Class record - 3 marks and Field report – 2 marks.**

II BSc BOTANY-Open Elective Course (BOTOEC04)

Title of the paper: Plant Wealth (Practical based)

Type of course	Credits	Instruction hours per week	Duration of Exam	Formative assessment marks	Summative assessment marks	Total marks
BOT OEC04	03	Theory-2 Practical-2 Total-4 hrs	2hrs	40	60	100

Course Outcomes: After the end of the course, the students will be able to:

1. Classify the proteins, lipids, Minerals and their sources.
2. Recognize the basic medicinal plants.
3. Increase the awareness and appreciation of plants & plant products encountered in everyday life
4. Classify the cultivars according to scientific names.
5. Recognize the basic spices, oil yielding and timber plants.

UNIT	COURSE CONTENT	HOURS
I	<p>Plant nutraceuticals: Carbohydrates, proteins, lipids; Classification and Plant Sources. Plant Sources, role and deficiency symptoms of Vitamins and Minerals (Fe, Na, Ca, K, P, Zn and Mg)</p> <p>Cereals: Origin, botanical name, part used and uses of Wheat, Rice, maize, sorghum, Finger millet, Perl millet, Foxtail millet, Kodo millet.</p> <p>Pulses: Origin, Botanical name part used and uses of - Pigeon pea, Chickpea, Black gram, Green gram, Cowpea, Soya bean, Pea and Horse gram.</p>	10 Hrs
II	<p>Spices, Beverages, Oil and fats</p> <p>Spices: Origin, Botanical name, part used and uses of -Clove, Cardamom, Cinnamon, Cumin, Tamarind, Asafoetida, Fenugreek, Turmeric, Black Pepper, Zinger and Coriander.</p> <p>Beverages: Origin, growing countries and chemical constituents and uses of Tea and Coffee. Alcoholic beverages- wine preparation.</p> <p>Oils and fats: General description, extraction and uses of Sun flower, Groundnut, Coconut and Castor oil.</p> <p>Essential Oils: General description, extraction / distillation uses of - Lemongrass, Eucalyptus and Sandalwood.</p>	10Hrs
III	<p>Medicinal plants, Timber and fibre yielding plants</p> <p>Medicinal plants: Botanical name, Part used and uses of major medicinal plants- Ashwagandha, Shatavari, <i>Aloe vera</i>, Amla, Adathoda, <i>Terminalia</i>, Sarpagandha, <i>Tinospora</i>, <i>Centella</i>.</p> <p>Timber plants: General account and quality characteristics of timber wood. timber processing with special reference to, Rose wood and Teak wood.</p> <p>Fibre yielding plants: Importance of Cotton, Coir and Jute.</p>	10Hrs

PRACTICALS

1. Qualitative test for carbohydrates, proteins and lipids.
2. Estimation of ascorbic acid content in a given plant sample.
3. Study of Cereals and Millets included in the syllabus.
4. Study of Pulses and Spices included in the syllabus.
5. Study of Beverages included in the syllabus.
6. Wine preparation from natural substrates.
7. Preparation of lemongrass /Eucalyptus oil by distillation process
8. Study of locally available medicinal plants.
9. Preparation of health mix and Triphala churna.
10. Research centre /Industrial visit (CFTRI /Food processing / Brewing etc)

Suggested Readings

1. Chrispeels, M.J. and Sadava, D.E. (1994) Plants, Genes and Agriculture. Jones & Bartlett Publishers. CSIR- Central Institute of Medicinal and Aromatic Plants, Lucknow (2016).
2. Ayush Gyanya : Handbook of Medicinal and Aromatic Plant Cultivation.
3. Kochhar, S.L. (2016). Economic Botany: A Comprehensive Study. 5th Edition. Cambridge.
4. Samba Murty, AVSS and Subrahmanyam, N.S. (1989). a text book of Economic Botany. Wiley Eastern Ltd., New Delhi
5. Sambamurty, AVSS and Subrahmanyam, N.S. (2008). A Textbook of Modern Economic Botany.
6. Verma.V (2009) Text book of Economic Botany. Ane books Pvt Ltd Bangaluru.

Note: No separate practical examination for OEP.

10% of questions from practical part included in theory question Paper.