

**UNIVERSITY OF KERALA**  
**THIRUVANANTHAPURAM**



**COMPLEMENTARY COURSE**

**BOTANY**

*FOR*

**FIRST DEGREE PROGRAMME IN ZOOLOGY/ HOME SCIENCE/BIOCHEMISTRY**

*UNDER*

**CHOICE BASED CREDIT- SEMESTER SYSTEM**  
*(w.e.f. 2022 admission onwards)*

**SEMESTER-I**

**MICROTECHNIQUE, ANGIOSPERM ANATOMY  
AND REPRODUCTIVE BOTANY**

**SEMESTER-II**

**THALLOPHYTES, ARCHEGONIATAE AND PLANT  
PATHOLOGY**

**SEMESTER-III**

**SYSTEMATIC BOTANY, ECONOMIC BOTANY,  
ETHNO BOTANY AND PLANT BREEDING**

**SEMESTER-IV**

**PLANT PHYSIOLOGY, PLANT ECOLOGY,  
HORTICULTURE AND PLANT  
BIOTECHNOLOGY**

Course code	Course title	Semester I		Semester II		Semester III		Semester IV		Total	
		Contact hours	Credit	Contact hours	Credit	Contact hours	Credit	Contact hours	Credit	Contact hours	Credit
BO1131	Microtechnique, Angiosperm Anatomy and Reproductive Botany	2	2							4	2
BO1231	Thallophytes, Archegoniatae and Plant pathology			2	2					4	2
BO1331	Systematic botany, Economic botany, Ethnobotany and Plant Breeding					3	3			5	3
BO1431	Plant Physiology, Ecology, Plant Biotechnology and Horticulture							3	3	5	3
BO1432	Practical BO1131,BO1231 ,BO1331 &BO1431	2		2		2		2		8	4
											14

## SEMESTER-I

### MICROTECHNIQUE, ANGIOSPERM ANATOMY AND REPRODUCTIVE BOTANY

Course code : BO 1131 Number of credits : 2

Number of contact hours: (Lecture -36 hrs : Practical- 36hrs) Total -72 hrs

Distribution of Hours	Theory	Practical
Microtechnique	06 hrs	02hrs
Angiosperm anatomy	20 hrs	30hrs
Reproductive Botany	10 hrs	04 hrs
Total	36 hrs	36 hrs

**Aim of the course:** To generate awareness about anatomical features of Angiosperms & reproductive biology as well as to learn techniques for micropreparations.

#### Objectives:

- To develop skills for preparation and identification of microscopic structures
- To distinguish various tissue systems and internal structure
- To acquire basic knowledge about embryo development and pollen grains

#### MODULE-I

##### Microtechnique

6hrs

1. Killing and Fixing agents – Carnoy's formula, FAA.
2. Stains and Staining techniques- Double staining. General account; Stains: Saffranin, Haematoxylin, Acetocarmine.

#### MODULE-II

##### Angiosperm Anatomy

10hrs

1. Objective and scope of plant anatomy
2. Tissues – Meristems, Definition, Classification based on origin, position, growth patterns, functions.
3. Apical meristems & theories on apical organization - Apical cell theory, Histogen theory, Tunica -Corpus theory. Organization of root apex in dicots & monocots (Kopper-Kappe theory).
4. Permanent tissues – Definition, classification - simple, complex and secretory.
5. Tissue systems – Epidermal tissue systems, Ground tissue systems & vascular tissue systems. Different types of vascular arrangements

### MODULE-III

10hrs

1. Primary structure – Root, stem and leaf [Dicot & Monocot]. Secondary growth (Stelar and extra stelar)- Root and stem- cambium (structure and function) annual rings, heart wood and sap wood, tyloses, ring porous wood and diffuse porous wood, Periderm formation-Phellum, Phellogen and Phelloderm ; Lenticels
2. Anomalous secondary growth –*Boerhaavia*.

### Practical

32hrs

1. Familiarize Killing and Fixing agents, Stains
2. Simple permanent tissue – Parenchyma, Chlorenchyma, Aerenchyma, Collenchyma and Sclerenchyma
3. Primary structure – Dicot stem: *Centella*.
4. Monocot stem: Grass.
5. Dicot root: Pea or *Limnanthemum*
6. Monocot root: *Colocasia*.
7. Secondary structure - Stem [Normal type]-*Vernonia*.
8. Secondary structure - Root [Normal type]- *Carica papaya*; Aerial root -*Tinospora/ Ficus*.
9. Anomalous secondary thickening – *Boerhaavia*

### MODULE- IV

#### Reproductive Botany

10hrs

1. Micro sporogenesis - structure and functions of wall layers.
2. Development of male gametophyte - Dehiscence of anther.
3. Megasporogenesis - Development of female gametophyte - Embryo sac development and type - Monosporic – *Polygonum* type.
4. Pollination - Fertilization - Double fertilization. Structure of Embryo- Dicot [*Capsella*],

### Practical

4hrs

Students should be familiar with the structure of anther and embryo,

(Permanent slides can be used)

### REFERENCES

1. Bhojwani S S (1974) The Embryology of Angiosperms, 6<sup>th</sup> edition Vikas publishers
2. Coutler E. G. (1969) Plant Anatomy – Part I Cells and Tissues – Edward Arnold, London.
3. Esau K. (1965) Plant Anatomy – Wiley Eastern, New York.
4. Fahn A. (1985) Plant Anatomy – Pergamon Press, Oxford.

5. Maheswari P (1950) An Introduction to the Embryology of Angiosperms – McGraw Hill, New York
6. Pandey, B .P. (1997) Plant Anatomy - S.Chand and co. New Delhi
7. Pijush Roy (2006) Plant Anatomy. New Central Book Agency (P) Ltd
8. Prasad and Prasad (1972) Out lines of Botanical Micro technique, Emkay publishers, New Delhi.
9. Vashista.P. C (1984) Plant Anatomy – Pradeep Publications – Jalandhar

## SEMESTER-II

### Thallophytes, Archegoniatae and Plant pathology

Course code : BO 1231 Number of credits : 2

Number of contact hours : 36 hrs (Lecture); 36 hrs (Practical) Total- 72 hours

Distribution of Hours	Theory	Practical
Thallophytes I - Algae	09 hrs	08 hrs
Thallophytes II – Fungi & Lichens	09 hrs	08 hrs
Plant Pathology	03 hrs	04 hrs
Archegoniatae I - Bryophyta	06 hrs	06 hrs
Archegoniatae II - Pteridophyta	06 hrs	06 hrs
Archegoniatae III - Gymnosperms	03 hrs	04 hrs
<b>Total</b>	<b>36 hrs</b>	<b>36 hrs</b>

**Aim of the course:** To create awareness about the world of microbes and non flowering plants.

#### Objectives:

- To familiarize characteristic features of microbes and their significance in environment
- To generate idea about types of algae, fungi, lichen and their economic as well as evolutionary significance
- To familiarize the students the characteristic features, life cycle and evolutionary significance of Bryophytes, Pteridophytes and Gymnosperms.
- To impart knowledge about diseases in plants

#### MODULE-I

##### Thallophytes I - Algae

9hrs

1. Salient features of the following major groups with reference to the structure, reproduction and life cycle of the types given below (Excluding the developmental details)–
  - a) Cyanophyceae -*Nostoc*
  - b) Chlorophyceae - *Chlorella*, *Oedogonium* and *Chara*
  - c) Phaeophyceae -*Sargassum*
  - d) Rhodophyceae –*Polysiphonia*

##### Practical

8 hrs

1. Make micro preparations of vegetative and reproductive structures of the types mentioned in the syllabus.
2. Identify the algal specimens up to the generic level and make labeled sketches of the specimens observed

## MODULE-II

### Thallophytes II – Fungi & Lichens

9hrs

1. Characteristic features of the following major groups with reference to the structure, reproduction and life cycle of the types given below (Excluding the developmental details)–

a. Zygomycotina-*Rhizopus*

b. Ascomycotina

i. Discomycetes-*Peziza*

c. Basidiomycotina

i. Teliomycetes –*Puccinia*

2. Economic importance of Fungi

3. General account and economic importance of Lichens; Morphological and anatomical features of *Usnea*

#### Practicals

8 hrs

A detailed study of structure and reproductive structures of types given in the syllabus and submission of record.

*Rhizopus*, *Peziza*. *Puccinia*. And *Usnea*.

## MODULE III - Plant Pathology

3 hrs

1. A brief account on the following plant diseases with reference to the symptoms, causative organism, spread of the disease and effective control measures.

a) Brown spot disease of Paddy

b) Powdery mildew of Rubber

c) Tapioca Mosaic Virus

d) Quick wilt of Pepper

2. Method of preparation and mode of action of the following fungicides- Bordeaux mixture, Tobacco decoction.

#### Practical

4 hrs

Students are expected to observe the symptoms and causal organisms of all plant diseases mentioned above.

## MODULE-IV

6hrs

### Archegoniatae I - Bryophyta

1. Introduction and Classification

2. Study of the habit, thallus organization, vegetative and sexual reproduction and alternation of generation of the following types (Developmental details are not required).

3. *Riccia*, *Funaria*

4. Economic Importance of Bryophytes.

#### Practical

6 hrs

1. *Riccia*– Habit - Internal structure of thallus – V. S. of thallus through archegonia, antheridia and sporophyte

2. *Funaria*– Habit, V. S. of archegonial cluster, V.S. of antheridial cluster, Sporophyte V.S.



**Archegoniatae II - Pteridophyta** **6 hrs**

1. Introduction: General characters morphological and phylogenetic classification.
2. Study of the habitat, habit, internal structure, reproduction and life cycle of the following types (Developmental details not required). *Selaginella* and *Pteris*

**Practical** **6 hrs**

1. *Selaginella*: Habit, stem and rhizophore T. S., V.S. of strobilus, Megasporophyll and microsporophyll.
2. *Pteris*- Habit, Rhizome and petiole T. S., sporophyll T.S

**MODULE-V**

**Archegoniatae III - Gymnosperms** **3 hrs**

1. Introduction and classification of gymnosperms.
2. Study of the Habit, Anatomy, Reproduction and life cycle of *-Pinus* (Developmental details are not required)

**Practical** **4 hrs**

*Pinus*- Branch of indefinite growth, spur shoot, T. S of old stem and needle, male and female cone, V.S. of male and female cone.

**REFERENCES**

1. Alexopoulos C.J & Mims C.V (1988). Introductory Mycology, John Wiley & Sons.
2. Andrews H.N. (1967) - Studies on Palaeobotany – C .J.Felix.
3. Arnold C. A (1947) - Introduction to Palaeobotany – McGraw Hill Co. New Delhi.
4. Fritsch F. B (1945) Structure and Reproduction of Algae Vol.I& II. Cambridge University Press.
5. Gupta V .K. and Varshneya U. D (1967) – An Introduction to Gymnosperms
6. Jim Deacon (2007) Fungal Biology, 4th edition, Blackwell Publishing, Ane Books Pvt.Ltd.
7. Kanika Sharma (2009) Manual of Microbiology, Ane Books Pvt.Ltd.
8. Mamatha Rao (2009) Microbes and Non flowering plants, Impact and applications; Ane Books Pvt.Ltd.
9. Parihar N .S. (2015). An introduction to Bryophyta - Central Book Depot. Allahabad
10. Singh V., Pandey P.C and Jain D.K (1998) A Text book of Botany for Undergraduate Students, Rastogi Publications.
11. Smith G.M (1955) Cryptogamic Botany Vol.I, McGraw Hill
12. Vasishta B.R (1990) Botany for Degree Students, Algae, S. Chand & Co.
13. Smith G.M (1955) Cryptogamic Botany, Vol.I Mc Graw Hill.
14. Smith G.M. (1955) - Cryptogamic Botany – Vol.II – Mc Graw Hill Co. New Delhi
15. Sporne K. R. (1966) - Morphology of Pteridophytes - Hutchin University Library London
16. Vashishta B.R. (1990) Botany for Degree Students, Fungi, S.Chand & Co.
17. Vashishta B. R. (1993) - Pteridophyta – S.Chand and co. New Delhi
18. Vasishta B. R. (2018). Bryophyta - S. Chand and Co. New Delhi
19. Webster J (1970) Introduction to Fungi, Cambridge University Press.
20. Bower F.O. (1935) - Primitive Land Plants - Cambridge, London.

## SEMESTER-III

### SYSTEMATIC BOTANY, ECONOMIC BOTANY, ETHNO BOTANY, PLANT BREEDING

Course code :BO 1331      Number of credits : 3

Number of contact hours: (Lecture 54& Practical 36) Total-90 hrs

Distribution of Hours	Theory	Practical
Systematic Botany	33hrs	32 hrs
Economic botany	08hrs	04 hrs
Ethnobotany	02hrs	00 hrs
Plant Breeding	11hrs	00 hrs
<b>Total</b>	<b>54 hrs</b>	<b>36 hrs</b>

**Aim of the course:** To understand classification, identification and ethnobotanical importance of angiosperms along with plant breeding techniques.

#### Objectives:

- To introduce importance of morphological characters in classification and plant identification.
- To develop skill in identification of plants.
- To acquire knowledge about economic, ethnobotanical significance and pharmacognosy of plants
- To get knowledge about plant breeding techniques

#### MODULE- I

##### Systematic Botany

**11 hrs**

1. Floral morphology: Parts of a flower, types of inflorescence – Cymose (Simple, monochasial & Dichasial), Racemose- (Simple raceme, Corymb, Spike, Head), Special type- Cyathium (Brief account only) aestivation and placentation, Types of Fruits - Simple fruits - dry (Pea), Fleshy (Mango), Aggregate fruits (*Polyalthia*), Multiple fruits (Jack fruit) - Floral diagram and Floral formula.

2. Definition, scope and significance of Taxonomy.

3. Systems of classification:

- a. Artificial
- b. Natural - Bentham and Hooker (detailed account)
- c. Phylogenetic

4. Basic rules of Binomial Nomenclature. Definition and importance of Herbarium.

**MODULE-II****22 hrs**

A study of the following families with emphasis on the morphological peculiarities and economic importance of its members. (Based on Bentham and Hooker's System)

- |                |                   |
|----------------|-------------------|
| 1) Annonaceae  | 7) Apocynaceae    |
| 2) Malvaceae   | 8) Solanaceae     |
| 3) Rutaceae    | 9) Verbenaceae    |
| 4) Leguminosae | 10) Euphorbiaceae |
| 5) Rubiaceae   | 11) Liliaceae     |
| 6) Asteraceae  | 12) Poaceae       |

**Practical /fieldwork****32 hrs**

1. Students must be able to identify the angiosperm members included in the syllabus. Draw labeled diagram of the habit, floral parts, L.S of flower, T.S of ovary, floral diagram, floral formula and describe the salient features of the member in technical terms.
2. Students must submit the practical records at the time of practical examination.

**MODULE-III****Economic Botany****8 hrs**

Study of the Botanical name, Family, Morphology of useful parts, and utility of the following;

- Cereals and Millets – Paddy and Ragi
- Legumes - Ground nut, Blackgram.
- Sugar yielding plants -Sugarcane.
- Spices & condiments - Cumin, Clove, Cardamom and Pepper
- Fibre -Cotton
- Dyes -Henna
- Resins -Asafoetida.
- Tuber crops - Tapioca, Colocasia.
- Tropical Fruits - Banana, JackFruit.
- Oil yielding - Sesame oil, Coconut.
- Medicinal plants - *Ocimum*, *Adhatoda*, *Sida*, Turmeric.

**Practical****4 hrs**

Identify the economic products obtained from the plants mentioned under Economic Botany.

**MODULE-1V****Ethnobotany****2 hrs**

1. Study of common plants used by tribes-Neem, *Trichopuszeylanicus*

## MODULE-V

### Plant Breeding

11 hrs

1. Introduction, objectives in plant breeding.
2. Plant introduction - Agencies of plant introduction in India, Procedure of introduction - Acclimatization - Achievements.
3. Selection - mass selection, pure line selection and clonal selection.
4. Procedure of hybridization, inter generic, inter specific, inter varietal hybridization with examples. Composite and synthetic varieties.
5. Heterosis and its exploitation in plant breeding.
6. Polyploidy breeding (brief account).
7. Breeding for disease resistance (brief account).
8. Mutation breeding (brief account).

### REFERENCES

1. Acquah G (2007). Principles of Plant Genetics and Breeding, Blackwell Publishing Ltd. USA
2. Allard RW (1999). Principles of Plant Breeding (2<sup>nd</sup> Edition), John Wiley and Sons.
3. Davis, P.H. and Haywood, V.H. (1963). Principles of Angiosperm Taxonomy. Oliver and Royd, London.
4. Heywood, V.H. and Moore D.M. (1984). Current Concepts in Plant Taxonomy. Academic Press, London.
5. Jain, S.K. (1987). A Manual of Ethno botany. Scientific Publishers, Jodhpur
6. Jeffrey, C. (1982). An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge London.
7. Jones, S.B. Jr. and Luchsinger, A.E. (1986). Plant Systematics (2<sup>nd</sup> edition). McGraw-Hill Book Co., New York
8. Kapoor LD, (2001). Hand Book of Ayurvedic Medicinal Plants, CRC Press
9. Lawrence. G.H.M. (1951). Taxonomy of Vascular Plants. Macmillan, New York.
10. Naik, V.N. (1984). Taxonomy of Angiosperms. Tata McGraw Hill, New York.
11. Nordenstam. B., El-Gazaly, G. and Kassas. M. (2000). Plant Systematics for 21<sup>st</sup> Century Portland Press Ltd., London.
12. Pandey SN and Misra SP (2008) Taxonomy of Angiosperms; Ane Books Pvt.Ltd.
13. Radford. A.E. (1986). Fundamentals of Plant Systematics Harper and Row, New York.
14. Singh. G. (1999). Plant Systematics: Theory and Practice Oxford & IBH Pvt, Ltd. New Delhi.
15. Sivarajan, V.V. (1991). Introduction to the principle of plant taxonomy, Oxford and IBH Publishing Company
16. Stace. C.A. (1989). Plant Taxonomy and Biosystematics. 2<sup>nd</sup> ed. Edward Arnold, London.
17. Verma V, (2009) Text Book of Economic Botany; Ane Books Pvt. Ltd.
18. Woodland. D.E. (1991). Contemporary Plant Systematics. Prentice Hall, New Jersey.

## SEMESTER-IV

### PLANT PHYSIOLOGY, PLANT ECOLOGY, HORTICULTURE AND PLANT BIOTECHNOLOGY

Course Code : 1431 Number of credits : 3

Number of contact hours: 54 hrs (Lecture); 36 hrs (Practical) Total-90 hrs

Distribution of Hours	Theory	Practical
Plant Physiology	30hrs	15hrs
Plant Ecology	08hrs	13hrs
Horticulture	06hrs	02hrs
Plant Biotechnology	10hrs	06hrs
<b>Total</b>	<b>54 hrs</b>	<b>36 hrs</b>

**Aim of the course:** To create awareness about physiological aspects of growth & metabolism along with knowledge about Ecology, horticulture and Biotechnology

#### Objectives:

- To understand physiology of absorption, photosynthesis and respiration.
- To study ecosystem and ecological modifications
- To generate awareness about horticultural techniques.
- To familiarize plant tissue culture techniques

#### MODULE-I

##### Plant Physiology

**10 hrs**

1. General introduction :physiological processes, their significance and applications.
2. Water relations of plants: Importance of water to plant life.
  - a. Absorption of water- organs of absorption, root and root hair. Physical aspects of absorption- imbibition, diffusion and osmosis. Plant cell as an osmotic system; water potential and osmotic potential. Plasmolysis and its significance, practical applications. Mechanism of water absorption – active and passive absorption, root pressure. Pathway of water across root cells.
  - b. Ascent of sap- vital and physical theories.
  - c. Loss of water from plants: transpiration - cuticular, lenticular and stomatal mechanism - theories – starch sugar hypothesis, potassium - ion theory. Significance of transpiration - guttation, anti - transpirants, factors affecting transpiration.
3. Mineral nutrition: macro and micro elements, role of essential elements and their deficiency symptoms. Mechanism of mineral absorption (a) passive absorption- ion exchange and Donnan equilibrium (b) active absorption- carrier concept.

**MODULE-II****10 hrs**

1. Photosynthesis: Introduction, significance and general equation. Photosynthetic apparatus, structure and function of chloroplast, quantasomes - solar spectrum and its importance - Fluorescence and Two pigment systems- raw material for photosynthesis- Mechanism of photosynthesis- Light reaction - cyclic and non cyclic photophosphorylation. Hill reaction - Dark reaction: Calvin cycle. Comparative study of C3, C4, and CAM plants. Photorespiration
2. Factors affecting photosynthesis - Law of limiting factors.

**MODULE-III****10 hrs**

1. Respiration: Introduction, definition and significance and general equation. Respiratory substances, types of respiration- aerobic and anaerobic. Aerobic respiration - glycolysis, Krebs's cycle, terminal oxidation. Anaerobic respiration – fermentation: alcoholic and lactic acid fermentation. Energy relation of respiration
2. R .Q and its significance – Factors affecting respiration.
3. Translocation of solutes: Path way of movement, phloem transport, mechanism of transport - Munch hypothesis, protoplasmic streaming theory - activated diffusion hypothesis, electro osmotic theory.
4. Growth: Phases of growth - vegetative and reproductive growth - growth curve – plant growth regulators - Auxins, Gibberellins, Cytokinins, Ethylene, Abscisic acid  
– synthetic plant hormones - practical applications. Senescence and abscission. Photoperiodism.

**Practical****15 hrs**

1. Water potential of onion peel / *Rhoeo* peel by plasmolytic method
2. Papaya petiole osmoscope.
3. Determination of water absorption and transpiration ratio.
4. Measurement of rate of transpiration using Ganong's potometer or Farmer's potometer.
5. Evolution of oxygen during photosynthesis.
6. Evolution of CO<sub>2</sub> during respiration.
7. Ganong's respirometer and measurement of R.Q.
8. Alcoholic fermentation using Kuhne's fermentation vessel.
9. Measurement of growth using Arc auxanometer.

**MODULE-IV****Plant Ecology****8 hrs**

1. Definition-Scope and relevance to society and human environment. Need for public awareness
2. Ecosystems-Concept of an ecosystem- structure and function of an ecosystem-
3. Biotic and abiotic components- Energy flow in an ecosystem.
4. Ecological succession-Definition- primary, secondary- hydrosere.
5. Food chains -Food web & ecological Pyramids.
6. Introduction- types, characteristic features, structure and functions of the following ecosystems.

A . 1. Forest ecosystem 2. Grass land ecosystem 3. Desert ecosystem 4 . Aquatic ecosystems - Ponds, Estuaries.

B. Morphological, anatomical & physiological adaptations of – Hydrophytes, Xerophytes, Halophytes, Epiphytes, Parasites.

**Practical** **13 hrs**

1. Study of ecological and anatomical modifications of Xerophytes, Hydrophytes, Halophytes, Epiphytes and Parasites.
2. Observation and study of different ecosystems mentioned in the syllabus.

## **MODULE-V**

**Horticulture** **6 hrs**

1. Introduction to Horticulture
2. Garden tools and implements - Lawn mower, hand trowel, nursery spade, spade fork, garden hoe, weeder, tillers
3. Methods of vegetative propagation: Cutting, grafting, budding, layering, special methods of propagation,
4. propagation by seeds.
5. Media for propagation of plants — soil, sand, peat, sphagnum moss, vermiculture, soil mixture,
6. Nursery beds
7. Manures – organic and inorganic

**Practical** **2 hrs**

1. Methods of vegetative propagation: Cutting, grafting, budding, layering, special methods of propagation - propagation by seeds.

## **MODULE - VI**

**Biotechnology** **10 hrs**

1. Introduction – History – major achievements – Biotechnology in India
2. Plant Tissue culture - Culture media; composition, preparation and sterilization – Totipotency: definition and importance - Dedifferentiation and redifferentiation – Callus and suspension culture, meristem culture - Somatic embryogenesis, Anther culture and production of haploids.

**Practical** **6 hrs**

1. Preparation of media, sterilization, inoculation and callus induction (Demonstration only).

## **REFERENCES**

1. Ahluwalia VK &Sunitha Malhotra (2009). Environmental science, Ane Books PvtLtd.
2. Bhattachargee. S.K(2006). Advances in ornamental horticulture. Pointer publications. Jaipur
3. Bose.T KJ. Kabir, P. Das and JoyPP(2001). Tropical horticulture. Naya

4. Chaha, K.I (2001). Handbook of horticulture. ICAR,delhi
5. Desh Beer Singh& Poonam Wasir (2002) – Bonsai – an art, scientificpublic. Jodhpur
6. Devlin & Witham (1983). Plant Physiology, C B Spublishers
7. Edwin Biles(2003). The complete book of gardening. Biotech.book. Delhi
8. ErachBharucha (2013). Text book of Environmental Studies for undergraduate Courses, Universities Press, University Grants Commission
9. Freitfelder D. (1976). Physical Biochemistry W. H.Freeman & Co Ltd.
10. Gupta P. K. (2010) Elements of Biotechnology (Rastogi publications).
11. Ignacimuthu S. J.(1996). Applied Plant Biotechnology (Tata McGraw Hill)
12. Kochhar P. L. & Krishnamoorthy H. N. (1985). Plant Physiology, Atmaram& Sons-Delhi, Lucknow.
13. Kumar &Purohit (2001). Plant Physiology - Fundamentals and Applications , Agro botanical publishers
14. Kumar H .D. (1983). Molecular Biology & Biotechnology (Vikas publishing) 31.Pamela Peters – Biotechnology: A guide to genetic engineering (WC Brown publishers)
15. Kumar.N (1999). An intro. To horticulture. Rajalekshmi publications Nagarcoil
16. Malic C. P. & Srivastava A. K.( 2015) Textbook of Plant Physiology , Kalyani Publishers- NewDelhi
17. Misra SP and Pandey SN (2009). Essential Environmental studies, Ane Books PvtLtd.
18. Noggle G R & Fritz G J (1983) Introductory Plant physiology 2<sup>nd</sup>Edition , Prentice Hall of India
19. Pandey S.N. & Sinha B. K (1996). Plant physiology, Vikas publishing House- NewDelhi
20. prakash public. Calcutta
21. Ramawat K. G. (2011). Plant Biotechnology (S. Chand & Company)
22. Razdan M. K. (2016). An introduction to Plant Tissue Culture (Oxford and I B H publishers)
23. Reinert J. and Bajaj Y. P. S (1982) . Plant cell, Tissue and Organ Culture (WC Brown Publishers).
24. Richard F Venn (2004). Principles and Practice of Bioanalysis, Taylor & Francis, Ane Books Pvt.Ltd
25. Salisbury F. B. & Ross C. W. (2005). Plant physiology. 4<sup>th</sup> Edition Wadsworth publishing company
26. Sharma.V K (2004). advances in horticulture, strategies production, plant protection and value addition – Deep and Deep public.Delhi
27. Singh S P (1999). Advances in horticulture and forestry. Scientific public, Jodhpur
28. Sobti R C and Suparna S Pachauri (2009). Essentials of Biotechnology,Ane Books Pvt. Ltd
29. SundaraRajan S (2016) . College Botany Vol.IV Himalaya publishing House
30. Verma V (2007). Text Book of Plant Physiology. Ane Books Pvt.Ltd
31. VictorianoValpuesta (2004). Fruit and Vegetable Biotechnology, CRC Press. New York. Ane Books Pvt. Ltd
32. William G. Hopkins (2008). Introduction to Plant Physiology, 4<sup>th</sup> Edition John Wiley & Sons, Newyork.



**MODEL QUESTION PAPER**

**FIRST SEMESTER B. SC. DEGREE (CBCSS) EXAMINATION**

**Complementary Botany for Zoology, Home Science and Biochemistry**

**BO1131- Microtechnique, Angiosperm Anatomy and Reproductive Botany**

**(2019 Admission Onwards)**

**Time : 3 Hours**

**Max.Marks : 80**

(Draw Diagrams wherever necessary)

**Section- A**

I. Answer **all** Questions, **each** carries **one** mark.

1. Name a killing and Fixing fluid
2. What are Tyloses?
3. What is middle lamella?
4. Define exarch condition
5. What is Dendrochronology?
6. Comment on closed vascular bundle
7. Write a note on Orthotropous ovule
8. What is Coleoptile?
9. What is palynology?
10. Name a complex tissue

**(10x1 = 10 marks)**

**Section –B**

II. Answer any **eight** of the following. **Each** carry **two** marks.

11. Comment on FAA
12. What is Histogen Theory
13. What are Annual rings
14. Explain Lenticels and their function
15. Give an account of laticiferous tissue
16. Write a note on Tapetum
17. Distinguish between endothecium and endothelium
18. Write down the structure of monocot embryo
19. Draw a labelled diagram of a bicollateral vascular bundle
20. Describe mesophyll tissue
21. What is double fertilization?
22. Describe glandular tissue

**(8x2=16 marks)**

**Section –C**

III. Answer any **six** of the following not more than 120 words. **Each** carry **four** marks.

23. Describe with labelled diagram the structure of Dicot leaf
24. Explain the salient features of periderm.
25. Distinguish between monocot and dicot root
26. Describe phloem and its function
27. Describe microsporogenesis
28. Describe different types of endosperm
29. Write an account heartwood and sapwood
30. Describe anomalous secondary thickening in *Boerhaavia* stem
31. Explain Hydathodes and the phenomenon of guttation **(6x4=24 marks)**

#### **Section –D**

IV. Write an essay on **any two** of the following, **each** carry **15** marks.

32. Explain meristematic tissues and various theories of apical organization of stem
33. Give an account of normal secondary thickening in a dicot stem with labelled diagrams
34. Describe megasporogenesis and development and structure of *Polygonum* type of embryo sac
35. Write an essay on permanent tissues with suitable diagrams **(2X15=30)**

**MODEL QUESTION PAPER**  
**SECOND SEMESTER B. SC. DEGREE (CBCSS) EXAMINATION**  
**Complementary Botany for Zoology, Home Science and Biochemistry**  
**BO1231- Thallophytes, Archegoniatae and Plant pathology**  
**(2019 Admission Onwards)**

**Time : 3 Hours**

**Max.Marks : 80**

(Draw Diagrams wherever necessary)

**Section- A**

I. Answer **all** Questions, **each** carries **one** mark.

1. Pigment which give red colour to Rhodophyceae.
2. Name a unicellular algae.
3. Reserve food material of Phaeophyceae.
4. Name the Causative organism of Quick Wilt of Rubber.
5. Name a coprophilous Fungus.
6. What is Peristome?
7. Write a note on Cup Fungi.
8. Give an example for fungicide.
9. What is Yellow Shower?
10. Give an example for heterosporous pteridophyte. **(10x1=10 marks)**

**Section –B**

II. Answer any **eight** of the following. **Each** carry **two** marks.

11. Why the endosperm of *Pinus* is haploid?
12. What are Pyrenoids?
13. Structure of the thallus of *Rhizopus*.
14. Write any two economic importance of Lichens.
15. Write short note on heteroecious fungus.
16. Explain Polyembryony
17. Write about any two root characters shown by Rhizophore of *Selaginella*.
18. Describe the receptacle in *Sagassum*.

19. Describe the mode of reproduction in *Chlorella*.
20. Write the difference between teleutospores and uredospores.
21. What are dwarf shoots?
22. What is alternation of generation?

(8x2=16 marks)

### Section –C

III. Answer any **six** of the following not more than 120 words. **Each** carry **four** marks.

23. Describe with labelled diagram the structure of sporophyte of *Funaria*.
24. Explain the salient features of Phaeophyceae.
25. Explain the parts of globule and nucule of *Chara*.
26. Describe the different types of pigments in Algae.
27. Write the ecological and economic importance of *Usnea*.
28. Describe the reproduction in *Pteris*.
29. Write an account on the reproduction in *Oedogonium*.
30. Write the causative organism, symptoms and control measures of Powdery Mildew of Rubber.
31. Explain the xerophytic adaptations found in the anatomy of *Pinus* needle.

(6x4=24)

### Section –D

Write an essay on **any two** of the following, **each** carry **15** marks.

32. Explain with diagrams the structure, reproduction and life cycle of *Polysiphonia*.
33. Give an account of different stages of life cycle of *Puccinia* with suitable Diagrams.
34. Describe the vegetative, sexual reproduction and alternation of generation in *Riccia*.
32. Write an essay on the reproduction and life cycle of *Selaginella*.

(2x15=30)

**MODEL QUESTION PAPER**

**THIRD SEMESTER B. SC. DEGREE (CBCSS) EXAMINATION**

**Complementary Botany for Zoology, Home Science and Biochemistry**

**BO 1331 : SYSTEMATIC BOTANY, ECONOMIC BOTANY, ETHNOBOTANY,  
PLANT BREEDING**

**(2019 Admission Onwards)**

**Time. 3 Hrs**

**Total Marks: 80**

*(Draw diagrams wherever necessary)*

**SECTION –A**

**I. Answer all** questions in one word or two sentences; Each question carries **one** mark.

1. What is the characteristic fruit of the family Rutaceae?
2. Give the binomial for Clove.
3. Write the floral formula of Annonaceae.
4. Define syngenesious stamen.
5. What is heterosis?
6. Give the binomial of “*Arogyapacha*”?
7. Write the morphology of useful part of Asafoetida.
8. Name the typical inflorescence of the family Euphorbiaceae.
9. Define plant introduction.
10. Give the binomial for Sugarcane.

**(1×10=10 marks)**

**SECTION B**

**II. Answer any eight** of the following :Each question carries **two** marks

11. Write down the binomial of any two tropical fruits.
12. What is emasculation? Briefly describe the procedure.
13. Write an account on breeding for disease resistance.
14. Give the binomial of any two oil yielding plants.
15. Differentiate between monadelphous and diadelphous stamen.
16. Briefly explain natural system of classification.
17. Explain descendingly imbricate aestivation.

18. What is acclimatization?
19. Give the binomial of any two medicinally important plants you have studied.
20. Give examples for two economically importance plants in Solanaceae.
21. Write down the basic rules for binomial nomenclature.
22. Briefly explain phylogenetic system of classification.

**(8×2=16 marks)**

### **SECTION C**

**III.** Answer **any six** of the following .Each question carries **four**marks

23. Describe the floral characteristic of the family Asteraceae.
24. What are the different types of placentation?
25. Write down the significance of herbarium.
26. What are the primitive characters of the family Annonaceae?
27. Write down the polyploidy method adopted for the genetic improvement of crops?
28. What are the principles of mass selection?
29. Why Poaceae is considered as an advanced family among Monocots?
30. Write down the binomial, family and morphology of useful part of any four spices you have studied.
31. Explain mutation breeding. Mention its achievements.

**(6×4=24 marks)**

### **SECTION D**

**IV.** Write an essay on **any two** of the following .Each question carries **fifteen**marks

32. Explain Bentham and Hooker's system of Classification. Write down the merits and demerits.
33. Briefly explain the various types of inflorescence you have studied.
34. Compare and contrast the vegetative and floral characters of the various sub families under Leguminosae.
35. What is hybridization? What are the different techniques employed in the production of hybrids? Explain different types of hybridizations.

**(2×15=30 marks)**

**MODEL QUESTION PAPER**  
**FOURTH SEMESTER B. SC. DEGREE (CBCSS) EXAMINATION**  
**Complementary Botany for Zoology, Home Science and Biochemistry**  
**BO 1431: PLANT PHYSIOLOGY, PLANT ECOLOGY, HORTICULTURE**  
**AND PLANT BIOTECHNOLOGY**  
**(2019 Admission Onwards)**

Time : 3 hours

Max. Marks. 80

*(Instruction: draw diagrams wherever necessary.)*

**SECTION – A**

**I.** Answer **all questions** in one word or one sentence. Each question carries **one Mark**.

1. Define Totipotency
2. What is Imbibition?
3. What is R.Q.?
4. Which are 'turgor operated valves' in plants ?
5. Name any two antitranspirants
6. Which are primary macro nutrients?
7. What is Redifferentiation?
8. Expand RuBP
9. What are Lithophiloushalophytes ?
10. What are drought escaping plants? **(10x1=10 Marks)**

**SECTION – B**

**II.** Answer **any eight** questions, not to exceed a paragraph. Each question carries **two** marks.

11. What is substrate level phosphorylation ? Give an example.
12. Write a note on plasmolysis.
13. Distinguish between apoplastic and symplastic pathways.
14. Comment on cohesion and adhesion properties of water.
15. What is Guttation?
16. Mention symptoms of deficiency due to phosphorus.
17. In a non-turgid cell  $DPD = OP - WP$ , explain.
18. How wind influence stomatal transpiration?
19. Write four major differences between respiration and photopiration.
20. Write about organic fertilizers.

21. Write a note on physiological effects of cytokinin.

22. Define food chain.

**(8x2=16 Marks)**

### **SECTION – C**

**III.** Answer **any six** questions, not to exceed 120 words. Each question carries **four** marks.

23. Explain the different phases of growth.

24. How plant cell act as an osmotic system?

25. Explain the structure of chloroplast with diagram.

26. Explain Red drop and Emerson's enhancement effect.

27. Write is note on water potential and its components.

28. What is grafting? Explain approach and wedge grafting.

29. What are different types of ecological pyramids?

30. Explain the role of Phytochrome in flowering.

31. Explain cyclic photophosphorylation with illustration

**(6x4=24 Marks)**

### **SECTION – D**

**IV.** Write essay on **any two** of the following, not more than three pages. Each question carries **15** marks.

32. Explain C3 pathway and briefly explain how it differs from C4 pathway?

33. Define callus and how it is produced? Explain somatic embyogenesis

34. What is ecological succession? Describe kinds of succession and mechanisms of succession.

35. Explain Krebs cycle and write a brief note on its significance.

**(2x15=30 Marks)**



## MODEL QUESTION PAPER

### B. Sc. Degree Programme (CBCSS) Practical Examination

#### Botany Complementary Practical -Course Code: BO1432

1. Make suitable micropreparation of **A**, identify giving reasons and describe its structure with the help of labelled diagram. Leave the preparation for valuation.

(Preparation-2, Labelled Diagram-2, Reasons-3, Identification-1)(**8 Marks**)

2. Refer the specimen **B** to its family giving reasons. **(8 Marks)**

(Identification-1, Reasons upto series-2, Description of plant in technical terms -2, Family characters-2)

3. Make micropreparations of **C** and **D**. Stain and mount in glycerine and leave the preparation for valuation. Draw a cellular diagram and identify giving reasons.

(Preparation-2, Labelled Diagram-1, Identification-1, Reasons-2) **(2 x 6 =12 Marks)**

4. Make a suitable micropreparation of **E**. Identify the ecological group and write the anatomical adaptations. **(5 Marks)**

(Ecological group-1, Morphological Adaptations-2, Anatomical Adaptations-2 )

5. Identify and draw labelled diagram of **F** **(3 Marks)**  
(Identification-1, Labelled diagram- 2)

6. Identify the disease **G** and name the causative organism. **(2 Marks)**  
(Disease-1, Causative organism-1)

7. With the help of a labelled diagram explain the aim and working of the experiment **H**.  
(Aim-1, Labelled Diagram-1, Working-2) **(4 Marks)**

8. Identify and write notes on **I** **(3 Marks)**  
(Identification-1, Notes-2)

9. Spot at sight specimens, **J, K** and **L** **(3 x 3 = 9 Marks)**

(Major group 1, Genus-1, Part of the plant-1)

10. Write the binomial, family and morphology of the useful part of **M** and **N**

(Binomial 1, Family-1, Morphology-1) **(3x2=6 Marks)**

**Record -20 marks (Content-15, Neatness-5)**

## KEY TO SPECIMENS

- A Anatomy - Primary Root/Stem  
Normal Secondary Dicot stem/Root (*Vernonia/Papaya*)/Aerial Root  
(*Ficus/Tinospora*) Anomalous Secondary Dicot Stem (*Boerhaavia*)
- B Taxonomy
- C Thallophyta/Bryophyta
- D Pteridophyta/Gymnosperm
- E Ecology-Hydrophyte/Xerophyte/Epiphyte
- F Embryology
- G Plant Pathology
- H Plant Physiology
- I Stains/Fixatives
- J Thallophyta
- K Bryophyta/Pteridophyta
- L Gymnosperms
- M Economic Botany
- N Economic Botany