

**COMPLEMENTARY COURSES FOR MODEL I B Sc ZOOLOGY****SEMESTER I**

**Complementary course 1                      Code: BO1CMT01**  
**CRYPTOGAMS, GYMNOSPERMS AND PLANT PATHOLOGY**  
**(Theory 36 hrs; Practical 36 hrs; Credits 2 + 1)**

**Objectives:**

- Acquire fundamental knowledge in plant science and to make the student to understand that Botany is an integral part of the human life and developments.
- Foster and encourage an attitude of curiosity, appreciation and enquiry of various life forms of plants.
- Understand the identifying characters of the different types included in the syllabus.
- Understand the diversity of plants with respect to Algae, Fungi, Lichens, Bryophytes, Pteridophytes and Gymnosperms.

**CRYPTOGAMS (27 hrs)****Module 1: Algae (13 hrs)**

General characters of algae and their classification up to classes (F E Fritsch); range of thallus variation in Algae. Reproduction and life history of the following groups with reference to the types mentioned: Cyanophyceae - *Nostoc*; Chlorophyceae - *Oedogonium* (*Volvox*, *Spirogyra*, *Cladophora* - vegetative features only); Phaeophyceae – *Sargassum*; Rhodophyceae – *Polysiphonia*.

Economic importance of Algae: food, industry, medicine, biofertilizers; algal bloom.

**Module 2: Fungi and lichens (9 hrs)**

General characters and outline on the classification of fungi by Ainsworth. General characters, thallus structure, reproduction and life history of the following groups with reference to the types mentioned: Zygomycotina – *Rhizopus*; Ascomycetes – *Xylaria*; Basidiomycetes – *Puccinia*.

Economic importance of Fungi: as food, industry, decomposition of organic matter. Fungal toxins and human health.

Lichens: Classification based on thallus morphology. *Usnea* - morphology and anatomy of vegetative and reproductive structure. Economic importance of lichen: food, industry, medicine.

**Module 3: Bryophytes (2 hrs)**

General characters of Bryophytes. Morphology, anatomy, reproduction and life cycle of *Riccia*.

**Module 4: Pteridophytes (3 hrs)**

General characters of Pteridophytes. Morphology, anatomy (stem), reproduction and life cycle of *Selaginella*.

**Module 4: GYMNOSPERMS (4 hrs)**

General characters of Gymnosperms. Morphology, anatomy (leaf let), reproduction and life cycle of *Cycas*.

**PLANT PATHOLOGY (5 hrs)****Module 5: Plant diseases (5 hrs)**

Classification of plant diseases on the basis causative organism and symptoms. Study the following diseases with special emphasis on causative organism, symptoms and control measures:

- (i) Nut fall of Arecanut (ii) Bacterial blight of Paddy (iii) Leaf mosaic of Tapioca.

**PRACTICAL (36 hrs)**

1. Micropreparation and identification preparation of the following:

- (i) Algae: vegetative structure of *Nostoc*, *Volvox*, *Spirogyra*, *Oedogonium*, *Cladophora*, *Polysiphonia*. Vegetative and reproductive structure of *Sargassum*.
  - (ii) Fungi: vegetative and reproductive structure of *Rhizopus*, *Xylaria*, *Puccinia*.
  - (iii) Lichen: morphology of *Usnea* thallus and Apothecium.
  - (iv) Bryophytes: *Riccia* thallus anatomy.
  - (v) Pteridophytes: *Selaginella* - anatomy of stem and morphology of strobilus.
  - (vi) Gymnosperms: *Cycas* - Anatomy of leaflet, morphological features of megasporophyll, microsporophyll and ovule.
2. Identify plant diseases mentioned in the syllabus.

**REFERENCES**

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3. Bhatia K N, 1975. A treatise on Algae. S Chand and Co.
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5. Chaube H S, Ramji S, 2001. Introductory Plant Pathology. International Book Distributing Co. Lucknow.
6. Chopra R N, Kumra P K, 1988. Biology of Bryophytes. Wiley Eastern Ltd. New Delhi.
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8. Gangulee H C, Kar A K, 1993. College Botany Vol. II. New Central Book Agency, Calcutta.
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10. Mamatha Rao, 2009. Microbes and Non-flowering plants: Impact and applications. Ane Books Pvt. Ltd.
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**SEMESTER II**

**Complementary course 2**

**Code: BO2CMT02**

**PLANT PHYSIOLOGY**

**(Theory 36 hrs; Practical 36 hrs; Credits 2 + 1)**

**Objectives:**

- Make the students realize the importance of all physiological processes which take place in plants.
- Understand the mechanism of various physiological processes related to plant life.

**Module 1: Water relations (11 hrs)**

Plant water relations: Physical aspects of water absorption - Diffusion, DP, DPD. Imbibition. Osmosis - OP, Exosmosis, Endosmosis, Plasmolysis. Water potential and its components. Mechanism of water

absorption by root - active and passive absorption. Movement of water towards xylem by apoplast and symplast pathway. Ascent of sap – theories - transpiration pull theory, root pressure theory; guttation.

Transpiration: types, mechanism of transpiration and stomatal movement ( $K^+$  - ABA theory), significance and factors affecting transpiration, antitranspirants.

#### **Module 3: Mineral nutrition (4 hrs)**

General account on Micro and macro nutrients. Absorbable form, function and deficiency symptoms of the following mineral nutrients: N, P, K, Mg, B, Fe, Zn.

#### **Module 4: Photosynthesis and translocation of photosynthate (15 hrs)**

Basic requirements of Photosynthesis: Light - PAR; organs and site of photosynthesis; chloroplast. Photosynthetic pigments, photosynthetic unit; red drop and Emerson's enhancement effect; two pigment systems.

Mechanism of photosynthesis: light dependent reaction - cyclic and non cyclic photo phosphorylation. Light independent reaction (dark reactions) C<sub>3</sub> cycle, brief account on C<sub>4</sub> and CAM Cycles. Factors affecting photosynthesis. Photorespiration (brief study only).

Translocation of photosynthate and organic solutes: path of translocation, mechanism of translocation (Pressure Flow Hypothesis).

#### **Module 4: Growth and Development (6 hrs)**

Seed dormancy - causes of seed dormancy - methods of breaking dormancy. Germination of seeds - physiological changes. Growth: Phases of growth, plant growth regulators - auxins, gibberellins, cytokinins, abscissic acid and ethylene and their physiological role (brief study only). Photoperiodism - definition, short day plants, long day plants, day neutral plants. Vernalization.

### **PRACTICAL (36 hrs)**

#### **Core Experiments:**

1. Demonstration of osmosis using potato tuber osmoscope/Papaya petiole osmoscope.
2. Separation of leaf pigments by paper chromatography.
3. Compare the stomatal indices of hydrophytes and xerophytes.

#### **Demonstration experiments:**

1. Measure the rate of transpiration by Ganong's potometer.
2. Relationship between transpiration and absorption.
3. Measurement of growth using Arc Auxanometer.
4. Demonstration of geographic curvature using Clinostat.
5. Evolution of oxygen during photosynthesis.
6. Mohl's half leaf experiment.
7. Light screen experiment.

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**SEMESTER III**

**Complementary course 3**                      **Code: BO3CMT03**  
**ANGIOSPERM TAXONOMY AND ECONOMIC BOTANY**  
**(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)**

**Objectives:**

- Acquaint the student with the objectives and components of Taxonomy.
- Help the student to understand the systems of classification of angiosperms.
- Help the student to identify the common angiosperm species of Kerala.
- Familiarize the student with plants of immense economic importance.

**ANGIOSPERM TAXONOMY (36 hrs)****Module 1: Morphology (10 hrs)**

Leaf - simple, compound; venation and phyllotaxy. Flower as a modified shoot, structure of flower - floral parts, their arrangement, relative position; cohesion and adhesion of floral parts, symmetry of flowers; types of aestivation and placentation; floral diagram and floral formula. Inflorescence: racemose - simple, spike, spadix, catkin, corymb, umbel and head; cymose - simple, monochasial-helicoid and scorpioid; special types - cyathium, verticillaster. Fruits: outline on the classification; Simple: Fleshy - drupe, berry, hesperidium; Dry - Dehiscent - legume, capsule; Indehiscent - Caryopsis, Cypsella, Schizocarpic - lomentum, carcerulus, regma, cremocarp with examples. Aggregate. Multiple: sorosis, syconus. (Examples should be from families prescribed in the syllabus).

**Module 2: Plant classification and Herbarium techniques (8 hrs)**

Importance of plant classification, types of classification - artificial, natural and phylogenetic (brief account only); binomial nomenclature; ICBN (Brief account only). Bentham and Hooker's system of classification (up to series) and its merits and demerits. Cytotaxonomy and chemotaxonomy (brief account only). Herbarium techniques; importance of herbarium.

**Module 3: Angiosperm families (18 hrs)**

Study of the following families of Bentham and Hooker's system of classification with special reference to major identifying characters and economic importance: Annonaceae, Malvaceae, Rutaceae, Leguminosae (Mimosaceae, Caesalpinaceae and Fabaceae), Apiaceae (Umbelliferae), Rubiaceae, Asteraceae (Compositae), Apocynaceae, Lamiaceae (Labiatae), Euphorbiaceae, Arecaceae (Palmae), Poaceae (Gramineae).

**ECONOMIC BOTANY (18 hrs)****Module 4: Classes of economically important plants (10 hrs)**

Classification of economically important plants based on their uses. Study of the following groups of plants with special reference to their botanical name, family, morphology of useful part, economic products and uses: Cereals - Paddy, Wheat; Pulses - Green gram, Bengal gram; Tuber crops -

Tapioca; Spices - Pepper, Cardamom; Beverages - Tea, Coffee; Oil yielding plants - Coconut, Groundnut; Fibre yielding plants - Cotton, Coir; Timber yielding plants - Teak, Rose wood; Latex yielding plants - Para rubber; Bio pesticides - Neem, Tobacco; Ornamental plants - Rose, Orchids, Anthurium.

**Module 5: Medicinal plants (8 hrs)**

Study of the following medicinal plants with special reference to their binomial, family, morphology of useful parts and uses: *Adhatoda*, *Aloe*, *Bacopa*, *Catharanthus*, *Eclipta*, *Neem*, *Ocimum*, *Phyllanthus amarus*, *Rauwolfia*, *Sida*.

**PRACTICAL (36 hrs)**

1. Students should be trained to identify the different types of inflorescence and fruits of typical plants belonging to the families prescribed in the syllabus.
2. Students should be trained to identify typical local plants belonging to the families prescribed in the syllabus.
3. Students should be trained to describe the floral parts in technical terms and draw the L.S. of flower, construct the floral diagrams and write the floral formula of at least one flower from each family.
4. Study of the groups of plants mentioned in the economic botany syllabus with special reference to their botanical name, family, morphology of useful part, economic products and uses.
5. Students should study the botanical name, family, morphology of the useful part and the uses of the medicinal plants listed in the syllabus.

**REFERENCES**

1. Eames A J, 1969. *Morphology of Angiosperms*. McGraw Hill, New York.
2. Hill A F, 1952. *Economic Botany: A Text book of Useful Plants and Plant Products*. Tata McGraw-Hill Publishing Company Limited, New Delhi.
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**SEMESTER IV****Complementary course 4****Code: BO4CMT04****ANATOMY AND APPLIED BOTANY****(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)****Objectives:**

- Understand different types of plant tissues.
- Understand the internal structure of different plant organs with reference to their functions.
- Understand the process of normal and anomalous secondary thickening in plants.
- Know the morphological and anatomical adaptations of plants growing in different habitats.
- Understand how botanical knowledge could be applied for crop improvement.

**PLANT ANATOMY (27 hrs)****Module 1: Cells and tissues (9 hrs)**

Gross structure of primary and secondary cell walls; structure and function of plasmodesmata; non-living inclusions - cystolith, raphides; Tissues – meristematic and permanent, types of meristems; simple and complex tissues, secretory tissues (nectaries, hydathodes, mucilage ducts and lactiferous tissue).

**Module 2: Anatomy of plant organs (12 hrs)**

Primary structure of stem and root in dicots and monocots; anatomy of monocot and dicot leaf. Secondary thickening in dicot stem and dicot root, heart wood and sap wood; tyloses; hard wood and soft wood; growth rings, dendrochronology. Anomalous secondary thickening in *Bignonia*.

**Module 3: Ecological anatomy (6 hrs)**

Study of the morphological and anatomical adaptations of the following groups: Hydrophytes – *Nymphaea*, Hydrilla; Xerophytes – *Nerium*; Epiphytes - *Vanda*.

**APPLIED BOTANY: Plant breeding, Horticulture and Micropropagation (27 hrs)****Module 4: Plant breeding (12 hrs)**

Objectives of plant breeding, methods of plant improvement - plant introduction, acclimatization, plant quarantine; selection - mass selection, pureline selection and clonal selection; hybridization - intervarietal, interspecific and intergeneric; procedure of hybridization.

**Module 5: Artificial vegetative propagation methods (5 hrs)**

Propagation of plants through cutting, layering - air layering; budding T and patch budding; grafting - tongue and splice grafting. Role of cambium in budding and grafting.

**Module 6: Plant tissue culture (10 hrs)**

Principles of tissue culture, micropropagation - different steps - selection of explants, culture media – general composition and preparation; sterilization of media and explants; callus. Regeneration of plants: organogenesis, somatic embryogenesis; artificial seeds. Applications of plant tissue culture.

**PRACTICAL (36 hrs)**

1. Primary structure of stem and root of dicots and monocots; Dicot stem - *Centella*; Monocot stem – Bamboo, grass, asparagus; Dicot root - *Tinospora*; Monocot root - *Colocasia*, *Musa*.
2. Structure of dicot stem and dicot root after secondary thickening; Stem - *Vernonia*, *Eupatorium*; Root - *Tinospora*, *Papaya*.

3. Anomalous secondary thickening in *Bignonia*.
4. Anatomical adaptations of Hydrophytes - *Nymphaea* petiole, *Hydrilla* stem; Xerophytes - *Nerium* Leaf; Epiphytes - Velamen root of *Vanda*.
5. Emasculation of pea or *Caesalpinia* flower.
6. Demonstrate T and patch budding.
7. Demonstration of tissue culture techniques: culture media, surface sterilization and inoculation of explants.
8. Identification of non living inclusions - cystolith, raphides.

#### **REFERENCES**

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