Savitribai Phule Pune University

(Formerly University of Pune)

Three Year B.Sc. Degree Program in Botany

(Faculty of Science & Technology)

F.Y.B.Sc. (Botany)

Choice Based Credit System (CBCS) Syllabus

To be implemented from Academic Year 2019-2020
Title of the Course: B. Sc. (Botany)

Preamble:

The syllabus includes basic as well as advanced concepts in the plant sciences from first year to the third year shall inspire the students for pursuing higher studies in Botany and for becoming an entrepreneur and also enable students to get employed in the Botany subject based industries.

Introduction: Objectives:

1. This course is to ensure that you can achieve an up-to-date level of understanding of plant science.
2. Botany is a branch of biological science that focuses on the study of plants and how they survive and interact with other living and nonliving things in the environment. At the undergraduate and graduate levels, the curriculum for a botany degree typically consists of lecture-based courses, labs and field research.
3. A three-year bachelor's degree program in botany provides the foundation for prospective botanists to pursue a graduate level education or find an entry-level career.
4. To highlight the potential of these studies to become an entrepreneur.

Program Outcome:

1. **Knowledge and understanding** of the range of plant diversity in terms of structure, function and environmental relationships. The role of plants in the functioning of the ecosystem. A selection of more specialized, optional topics. Statistics as applied to biological data.
2. **Intellectual skills** – able to think logically and organize tasks into a structured form. Assimilate knowledge and ideas based on wide reading and through the internet.
3. **Practical skills**: Students learn to carry out practical work, in the field and in the laboratory, with minimal risk. They gain introductory experience in applying each of the following skills and gain greater proficiency in a selection of them
depending on their choice of optional modules. a. Interpreting plant morphology and anatomy. b. Plant identification. c. Vegetation analysis techniques. d. A range of physiochemical analyses of plant materials in the context of plant physiology and biochemistry. e. Analyze data using appropriate statistical methods and computer packages. f. Plant pathology to be added for sharing of field and lab data abstained.

4. **Scientific Knowledge**: Apply the knowledge of basic science, life sciences and fundamental process of plants to study and analyze any plant form.

5. **Problem analysis**: Identify the taxonomic position of plants, formulate the research literature, and analyze non reported plants with substantiated conclusions using first principles and methods of nomenclature and classification in Botany.

6. **Design/development of solutions**: Design solutions from medicinal plants for health problems, disorders and disease of human beings and estimate the phytochemical content of plants which meet the specified needs to appropriate consideration for the public health.

7. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern instruments and equipments for Biochemical estimation, Molecular Biology, Biotechnology, Plant Tissue culture experiments, cellular and physiological activities of plants with an understanding of the application and limitations.

8. **Environment and sustainability**: Understand the impact of the plant diversity in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

9. **Ethics**: Apply ethical principles and commit to environmental ethics and responsibilities and norms of the biodiversity conservation.
## Structure of Course:

### Structure B.Sc. Botany syllabus

<table>
<thead>
<tr>
<th>Year</th>
<th>Semester</th>
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Equivalence of Previous Syllabus:

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<tr>
<th>Old Course (2013 Pattern)</th>
<th>New Course (2019 CBCS Pattern)</th>
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<tr>
<td>Botany Theory Paper II Term I – Industrial Botany</td>
<td>BO 112 Plant morphology and Anatomy</td>
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<td>Fundamentals of Botany: PAPER - I Term- II: Morphology and Anatomy</td>
<td>BO 121 Plant life and utilization II</td>
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<td>Botany Theory Paper II Term- II – Industrial Botany</td>
<td>BO 122 Principles of plant science</td>
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<td>F. Y. B. Sc. Botany Practical Paper - III based on Theory Paper I and Paper II</td>
<td>BO 113 Practical based on BO 111 &amp; BO 112 and BO 123 Practical based on BO 121 &amp; BO 122</td>
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SEMESTER-I: PAPER-I

BO-111: PLANT LIFE AND UTILIZATION I (30 Lectures)

CREDIT-I 15 Lectures (15 Hours)

1. INTRODUCTION
   3 L
   General outline of plant kingdom (Lower Cryptogams: Thallophytes- Algae, Fungi & Lichens; Higher Cryptogams: Bryophytes and Pteridophytes; Phanerogams: Gymnosperms and Angiosperms- Dicotyledons and Monocotyledons). Distinguishing characters of these groups and mention few common examples from each.

2. ALGAE
   9 L
   2.1: Introduction
   2.2: General Characters
   2.3: Classification (Bold and Wynne 1978) up to classes with reasons
   2.4: Life Cycle of Spirogyra w.r.t. Habit, Habitat, Structure of thallus, structure of typical cell, Reproduction- Vegetative, Asexual and Sexual, systematic position with reasons
   2.5: Utilization of Algae in Biofuel Industry, Agriculture, Pharmaceuticals, Food and Fodder

3. LICHENS
   3 L
   3.1: Introduction
   3.2: General Characters
   3.3: Nature of Association, forms- Crustose, Foliose and Fruticose.
   3.4: Utilization of lichens.

CREDIT-II 15 Lectures (15 Hours)

4. FUNGI
   9 L
   4.1: Introduction
   4.2: General Characters
   4.3: Classification (Ainsworth, 1973)
   4.5: Utilization of Fungi in Industry, Agriculture, Food and Pharmaceuticals.

5. BRYOPHYTES
   6 L
   5.1: Introduction
   5.2: General Characters
   5.3: Classification (G.M. Smith 1955)
   5.4: Life Cycle of Riccia w.r.t. Habit, habitat, external and internal structure of thallus, Reproduction- vegetative, asexual and sexual- Structure of sex organs, fertilization, structure of mature sporophyte, structure of spore, systematic position with reasons.
   5.5: Utilization: Bryophytes as ecological indicators, agriculture, fuel, industry and medicine.
   (Development of sex organs not expected for all the above mentioned life cycles).
REFERENCES:
SEMESTER-I: PAPER-II
BO-112: PLANT MORPHOLOGY AND ANATOMY (30 Lectures)
CREDIT-I: 15 Lectures (15 hours)

1. MORPHOLOGY:
   1.1: Introduction, definition, descriptive and interpretative morphology.
   1.2: Importance in identification, nomenclature, classification, phylogeny and Plant breeding.

2. MORPHOLOGY OF REPRODUCTIVE PARTS:
   2.1: INFLORESCENCE:
      2.1.1 Introduction and definition
      2.1.2 Types:
         a) Racemose - Raceme, Spike, Spadix, Corymb, Umbel, Catkin and Capitulum.
         b) Cymose - Solitary, Monochasial- Helicoid and scorpioid; Dichasial and Polychasial.
         c) Special types - Verticillaster, Cyathium and Hypanthodium.
      2.1.3 Significance

   2.2: FLOWER:
      2.2.1 Introduction and definition
      2.2.2 Parts of a typical flower: Bract, Pedicel, Thalamus- forms, Perianth- Calyx and Corolla, Androecium and Gynoecium.
      2.2.3 Symmetry: Actinomorphic and zygomorphic, Sexuality- Unisexual and bisexual, Insertion of floral whorls on thalamus- Hypogyny, Epigyny and perigyny, Merous condition- Trimerous, tetramerous and pentamorous.
      2.2.4 Floral whorls:
         a) Calyx: Nature- Polysepalous, Gamosepalous; Aestivation- types, Modifications of Calyx- Pappus, Petaloid and spurred.
         b) Corolla: Forms of Corolla-
            i) Polypetalous- Cruciform and Papilionaceous.
            ii) Gamopetalous- Infundibuliform, Bilabiate, Tubular and Campanulate.
            iii) Aestivation- types and significance.
         c) Perianth: Nature- Polytetepalous, Gamotepalous.
         e) Gynoecium: Structure of typical carpel, number, position, cohesion and adhesion; placentation- types and significance.

   2.3: FRUITS:
      2.3.1 Introduction and definition
      2.3.2 Types of fruits:
         a) Simple: Indehiscent - Achene, Cypsela, Nut and Caryopsis.
            Dehiscent - Legume, Follicle and Capsule,
         b) Fleshy: Drupe, Berry, Hespiridium and Pepo.
         c) Aggregate: Etaerio of Berries and Etaerio of Follicles.
         d) Multiple fruits: Syconus and Sorosis.
CREDIT- II 15 Lectures (15 Hours)

3. ANATOMY: 2 L
3.1 Introduction and definition
3.2 Importance in Taxonomy, Physiology, Ecological interpretations, Pharmacognosy and Wood identification.

4. TYPES OF TISSUES: 8 L
   Outline with brief description, simple and complex tissues.
4.1: Meristmatic tissues: Meristem, characters and types based on origin, position and plane of division, functions.
4.2: Permanent tissues: Simple tissues - parenchyma, collenchymas, chlorenchyma and sclerenchyma.
4.3: Complex/Vascular tissues: Components of xylem and phloem, types of vascular bundles and functions.
4.4: Epidermal tissues: Epidermis, structure of typical stomata, trichomes, motor cells; functions.

5. INTERNAL ORGANIZATION OF PRIMARY PLANT BODY: 5 L
5.1: Internal structure of dicotyledon and monocotyledon root.
5.2: Internal structure of dicotyledon and monocotyledon stem.
5.3: Internal structure of dicotyledon and monocotyledon leaf.

REFERENCES:
BO 113: PRACTICALS BASED ON BO 111 & BO 112 (1.5 CREDITS)

1. Study of Life Cycle of Spirogyra. 1 P
2. Study of Life Cycle of Agaricus. 1 P
3. Study of Life Cycle of Riccia 1 P.
4. Study of forms of Lichens- Crustose, Foliose and fruticose. 1 P
5. Study of Mushroom Cultivation. 1 P
6. One day visit to study Algae, Fungi, Bryophytes and Lichens. 1 P
7. Study of Inflorescence. 2 P
   a. Racemose: Raceme, Spike, Spadix, Catkin, Corymb, Umbel and Capitulum
   b. Cymose: Solitary cyme, Uniparous cyme: helicoid and scorpioid, Biparous cyme and Multiparous cyme.
   c. Special type: Verticillaster, Hypanthodium and Cyathium.
8. Study of flower with respect to Calyx, Corolla and Perianth, Androecium and Gynoecium. 2 P
9. Study of fruits with suitable examples. 2 P
   a) Simple fruit: Dry: Achene, Cypsella and Legume; Fleshy: Berry and Drupe.
   b) Aggregate fruit: Etaerio of follicles and Etaerio of Berries.
   c) Multiple fruit: Syconus and Sorosis.
10. Study of internal primary structure of dicotyledonous root and stem e.g. Sunflower. 1 P
11. Study of internal primary structure of monocotyledonous root and stem e.g. Maize. 1 P
12. Study of internal primary structure of dicotyledonous and monocotyledonous leaf e.g. Sunflower and Maize. 1 P
SEMESTER-II: PAPER-I

BO-121: PLANT LIFE AND UTILIZATION-II (30 Lectures)

CREDIT-I 15 Lectures (15 hours)

1. INTRODUCTION: Introduction to plant diversity- Pteridophytes, Gymnosperms and Angiosperms with reference to vascular plants. 2 L

2. PTERIDOPHYTES: General characters, Outline classification according to Sporne (1976) up to classes with reasons. Life cycle of Nephrolepis w.r.t. Habit, habitat, distribution, morphology, anatomy of stem and leaf, Reproduction – vegetative and sexual. 11 L

3. Utilization and economic importance of Pteridophytes. 2 L

CREDIT-II 15 Lectures (15 hours)

1. GYMNOSPERMS: General characters, Outline classification according to Sporne (1977) up to classes with reasons. Life cycle of Cycas w.r.t. Habit, Habitat, Distribution, Morphology and Anatomy of Stem, leaf and reproductive organs- Male cone, Microsporophyll, microspores and megasporophyll, megaspore; structure of seed; Utilization and economic importance of gymnosperms. 8 L

2. ANGIOSPERMS: General characters, Outline of classification of Bentham and Hooker’s system up to series, comparative account of monocotyledons and dicotyledons. 4 L

3. Utilization and economic importance of Angiosperms: In food, fodder, fibers, horticulture and medicines. 3 L

REFERENCES:

SEMESTER-II: PAPER-II

BO-122: PRINCIPLES OF PLANT SCIENCE (30 Lectures)

CREDIT-1: PLANT PHYSIOLOGY AND CELL BIOLOGY

15 Lectures (15 Hours)

1. Introduction, definition and scope of plant physiology. 1 L
2. Diffusion – definition, factors affecting diffusion, importance of diffusion in plants, imbibition as a special type of diffusion. 1 L
3. Osmosis – definition, types of solutions (hypotonic, isotonic, hypertonic), endosmosis, exo-osmosis, osmotic pressure, turgor pressure, wall pressure, importance of osmosis in plants. 2 L
4. Plasmolysis – definition, mechanism and significance. 1 L
6. Structure of plant cell, differences between prokaryotic and eukaryotic cell. 1 L
7. Plant cell wall – components of primary cell wall, structure and functions. 1 L
8. Plasma membrane- bilayer and fluid mosaic model, components and functions 1 L
9. Ultrastructure and functions of chloroplast, mitochondria and endoplasmic reticulum. 2 L
10. Cell cycle in plants – phases of cell cycle (G1, M, G2 and S), importance of cell cycle in plants, divisional stages of mitosis and meiosis. 3 L

CREDIT-II: MOLECULAR BIOLOGY (15 Lectures) 15 Hours

1. Introduction and scope of molecular biology, central dogma of molecular biology. 2 L
2. Structure of DNA- Structure of nitrogen bases, nucleoside, nucleotide, Chargaff’s rule, C value paradox. 2 L
3. Watson Crick model of DNA and its characteristic features, types of DNA (A, B and Z DNA). 3 L
4. Packing of DNA into chromosomes, types of chromosomes. 2 L
5. Structure and types of RNA. 3 L
6. DNA replication- Types of replication (conservative, semi-conservative and dispersive), bacterial DNA replication (Initiation, elongation and termination), enzymes involved, leading and lagging strands, Okazaki fragments. 3 L

REFERENCES:

   Wadsworth Publishing Co. Belmont California, USA.

**BO 123: PRACTICALS BASED ON BO 121 & BO 122 (1.5 CREDITS)**

1. Study of life cycle of *Nephrolepis*. 1 P
2. Study of life cycle of *Cycas*. 1 P
3. Study of utilization and economic importance of Pteridophytes and Gymnosperms. 1 P
4. Study of comparative account of Dicotyledonous and Monocotyledonous plants 1 P
5. Study of utilization and economic importance of Angiosperms- food, fodder, fibers, horticulture and medicines. 1 P
6. One day visit to study diversity of vegetation. 2 P
7. To observe characteristic features of prokaryotic and eukaryotic plant cell. 1 P
8. Study of mitosis- preparation of slides using onion root tips to observe divisional stages. 1 P
9. Study of meiosis- preparation of slides using *Tradescantia*/ *Rhoeo*/ Maize / Onion flower buds to observe divisional stages. 2 P
10. Estimation of chlorophyll-a and chlorophyll-b by using suitable plant material. 1 P
11. Plasmolysis- endosmosis, exosmosis, incipient plasmolysis using *Rhoeo* leaf peeling and Demonstration of Osmosis- curling experiment. 1 P
12. DNA extraction using banana / phenol chloroform method or any suitable method and checking purity of DNA by 260:280 ratio. 2 P