University of Pune

S. Y. B. Sc. [Botany]

Class – S.Y. B .Sc. (To be implemented From June 2014)		
Paper	**Semester - I**	**Semester – II**
I	Taxonomy of Angiosperms and Plant Ecology	Plant Anatomy and Embryology
II	Plant Physiology	Plant Biotechnology
III	Practicals based on Theory courses (Paper I and II)	

Equivalence of previous syllabus at S.Y.B.Sc. Botany

Paper	**2008 Pattern (Implemented from 2009)**	**2013 Pattern (To be implemented from 2014)**
Paper I Semester I	BO-211: Fundamentals of Plant Systematics and Plant Ecology	BO-211: Taxonomy of Angiosperms and Plant Ecology
Paper II Semester I	BO-212:Fundamentals of Plant Physiology	BO-212:Plant Physiology
Paper I Semester I	BO-221: Structural Botany(Anatomy, Embryology and Palynology)	BO-221: Plant Anatomy and Embryology
Paper II Semester I	BO-222: Fundamentals of Plant Biotechnology	BO-222: Plant Biotechnology
Practical Course	Practical based on theory courses (Paper I and Paper II)	Practical based on theory courses (Paper I and Paper II)

S.Y.B.Sc. Botany

(Semester I, Paper I)

Taxonomy of Angiosperms and Plant Community (48 Lectures)

1. Introduction to Plant Taxonomy **3L**

1.1 Definition, scope, objectives and importance

1.2 Identification, classification, nomenclature

1.3 Concept of Systematics

2. Systems of classification **6L**

2.1 Types of systems with their merits and limitations- a)Artificial system- Carl Linnaeus , b)Natural system -Bentham and Hooker, c) Phylogenetic system- Engler and Prantl

3. Taxonomic literature **2L**

Flora, monograph, revisions, manuals, journals, periodicals and references books.

4. Sources of data for Systematics **6L**

4.1 Morphology

4.2 Anatomy

4.3 Cytology

4.4 Embryology

4.5 Phytochemistry

4.6 Molecular biology

5. Botanical Nomenclature **6L**

5.1 History

5.2 Binomial nomenclature

5.3 ICBN- principles

5.4 Rules of nomenclature

5.5 Coining of generic names and specific epithets.

5.6 Ranks and endings of taxa names

5.7 Principle of priority

5.8 Effective and valid publications

5.9 Single and double authority citation

5.10 *Nomina conservanda*

6. Study of Plant Families **11L**

Study of following families with reference to systematic position, salient features, floral formula, floral diagram and any five examples with their economic importance – Annonaceae, Meliaceae, Myrtaceae, Rubiaceae, Solanaceae, Asclepiadaceae, Euphorbiaceae and Amaryllidaceae

7. Computer in taxonomy **4L**

7.1 Concept of herbarium their advantages and limitations

7.2 Digital /e-herbarium and their advantages

7.3 Data bases: concept and needs.

7.4 Use of computer in plant classification

8. Introduction to ecology **5L**

8.1 Definition

8.2 Concept

8.3 Autecology and synecology

8.4 Ecosystem and its components: biotic and abiotic.

8.5 Food chain

8.6 Food web

8.7 Ecological pyramids

9. Ecological grouping of the plants **5L**

Ecological grouping of the plants with reference to their significance of adaptive external and internal features: a) Hydrophytes, b) Mesophytes c)Xerophytes d) Halophytes with examples.

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19. Theodore Cooke(1903)- The flora of The Presidency of Bombay Vol. I, II, III
20. V.V.Shivrajan-Introduction to Principles plant taxonomy
21. Yadav S.R. and Sardesai M.R.- Flora of Kolhapur District.

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(Semester I, Paper II)

Plant Physiology (48 Lectures)

1. Introduction to Plant Physiology **2L**

Brief history,Scope and applications of plant physiology

2. Plant – water relations **8L**

2.1 Physico-chemical properties of water

2.2 Membrane structure, permeability and aquaporin

2.3 Diffusion – Definition, factors affecting diffusion, importance of diffusion in plants

2.4 Osmosis – Definition, types of solutions – hypotonic, hypertonic and isotonic, endosmosis and exosmosis, concept of osmotic pressure (OP), turgor pressure (TP), wall pressure (WP), Diffusion pressure deficit (DPD), relation between OP, TP and DPD, role of osmosis in plants.

2.5 Plasmolysis – Definition, mechanism, deplasmolysis, significance of plasmolysis

2.6 Imbibition – Concept, mechanism and significance

3. Absorption of water **3L**

3.1 Role of water in plants

3.2 Concept of water potential and capillary water

3.3 Mechanisms of water absorption

3.4 Factors affecting rate of water absorption

4. Ascent of sap **4L**

4.1 Introduction and definition.

4.2 Theories of ascent of sap

4.3 Vital theories: Jamin – Chame theory and Bose theory

4.3.1 Physical force theories: a) Capillary theory, b) Imbibitional theory, c) Atmospheric pressure theory,

4.3.2 Transpiration pull or cohesion-tension theory, evidences and objections

4.4 Factors affecting ascent of sap

5. Transpiration **6L**

5.1 Definition

5.2 Types of transpiration – cuticular, lenticular and stomatal

5.3 Structure of stomata

5.4 Mechanism of opening and closing of stomata –Steward's hypothesis, active K^+ transport mechanism

5.5 Factors affecting the rate of transpiration

5.6 Significance of transpiration

5.7 Antitranspirants

5.8 Guttation

5.9 Exudation

6. Plant growth and plant growth regulators 6L

6.1 Introduction

6.2 Phases of growth

6.3 Measurement of growth- Arc auxanometer, Bose crescograph, fresh and dry weight method

6.4 Factors affecting growth

6.5 Plant Growth Regulators- Introduction and definition

6.6 Properties and practical applications of auxins, cytokinins, gibberellins, ethylene and abscisic acid

7. Nitrogen metabolism 8L

7.1 Introduction

7.2 Biological nitrogen fixation

7.2.1 Symbiotic nitrogen fixation, nitrogenase enzyme- structure and function

7.2.2 Non-symbiotic nitrogen fixation

7.3 Denitrification, ammonification and nitrification

7.4 Reductive amination and transamination

7.5 Role of nitrogen in plants

8. Seed dormancy and germination 4L

8.1 Definition and types of seed dormancy

8.2 Methods to break seed dormancy

8.3 Metabolic changes during seed germination

9. Physiology of flowering 7L

9.1 Photoperiodism – Concept, definition, short day plants, long day plants and day neutral plants, photoperiodic induction, phytochrome and flowering

9.2 Phytohormones and initiation of flowering

9.3 Applications of photoperiodism

9.4 Vernalisation – concept and definition, mechanism of vernalisation, applications of vernalisation, devernalization

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1. Bidwell, R.G.S. 1974. Plant Physiology. Macmillan Pub. Co., N.Y.
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(Semester II, Paper I)

Plant Anatomy and Embryology (48 Lectures)

Plant anatomy:

1. Introduction **2L**

Definition, scope of plant anatomy and types of tissues

2. Epidermal tissue system **4L**

Structure and function of epidermal tissue system, uniseriate and multiseriate epidermis, stomata: structure, types and functions, epidermal outgrowth: glandular and non-glandular

3. Mechanical tissue system **4L**

Principles involved in distribution of mechanical tissues – inflexibility, incompressibility, inextensibility and shearing stress, tissues providing mechanical support, their distribution in leaf, stem and root of dicots and monocots.

4. Vascular tissue system **4L**

Structure and function of xylem, phloem and cambium

5. Normal secondary growth **5L**

Introduction, cambium and its role, process in stems of *Helianthus annus* and *Annona sqamosa*, extrastelar and intrastelar secondary growth**,** annual rings, periderm, bark, tylosis and lenticel

6. Anomalous secondary growth **5L**

Introduction, causes, anomalous secondary growth in dicot stem (*Bignonia*) dicot root (*Raphanus*) and monocot stem (*Dracaena*).

Plant Embryology

7. Introduction **1L**

Definition and scope of plant embryology

8. Microsporangium and male gametophyte **5L**

a. Microsporangium**:** structure of tetrasporangiate anther, types of tapetum, sporogenous tissue.
b. Microsporogenesis: process and its types, types of microspore tetrad.
c. Male gametophyte: structure and development of male gametophyte.

10. Megasporangium and female gametophyte: 7L

a. Megasporangium: structure, types of ovules – anatropous, orthotropous, amphitropous, campylotropous, circinotropous.
b. Megasporogenesis: tenuinucellate and crassinucellate ovules, types of megaspore tetrads.
c. Female gametophyte: structure of typical embryo sac, types of embryo sacs with examples – monosporic, bisporic and tetrasporic.

11. Fertilization: 5L

Mechanism of pollination- entomophily, anemophily, hydrophily, zoophily, germination of pollen grain, double fertilization (syngamy and triple fusion) and its significance.

12. Endosperm and embryo 6L

a. Endosperm: Types – nuclear, helobial and cellular.
b. Embryogeny**:** structure of dicot and monocot embryo and seed formation.

References

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11. Nair P K K Essentials of Palynology.

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(Semester II, Paper II)

Plant Biotechnology (48 Lectures)

1. **Introduction** **2L**

1.1 Biotechnology- Definition, concept and scope

1.2 Interdisciplinary nature of biotechnology

2 . **Enzyme Technology** **7L**

2.1 Introduction, definition and properties of enzymes.

2.2 Classification of enzymes

2.3 Industrial applications of enzymes.

2.4 Production of amylase, proteases and lipase enzyme

2.5 Enzymes immobilization - concept and techniques of immobilization

3. **Fermentation Technology**. **7L**

3.1 Introduction.

3.2 Liquid and solid state fermentations

3.3 Principles of microbial growth

3.4 Bioreactors used in fermentations- stirred tank and tubular tower and digestive tank fermenters

3.5 Media composition for liquid and solid state fermentations

3.6 Industrial applications of fermentation

3.7 Downstream processing- citric acid production.

4. **Single cell protein** **5L**

4.1 Introduction

4.2 Need of proteins in diet

4.4 Production of SCP from algae (*Spirulina*) and fungi (Yeast)

4.5 The economic implications of SCP

4.6 Acceptability of SCP

5. **Environmental Biotechnology** **6L**

5.1 Introduction

5.2 Phytoremediation- definition and concept

5.3 Methods of phytoremediation- Rhizofilteration, phytoextraction, phytostabilization, phytovolatization, phytodegradation,

5.4 Environmental sustainability

6 . **Basics of plant genetic engineering** **7L**

6.1 Introduction and structure of DNA

6.2 Structure of gene in prokaryots and eukaryots- Promoter, coding region and terminator

6.3 General method of gene isolation from the plants-DNA isolation, restriction enzymes, restriction digestion of DNA, DNA electrophoresis, southern hybridization, lygation of DNA fragments

6.4 Gene cloning- vectors used for gene cloning

7**. Methods of gene transfer in plants** **8**L

7.1 Direct gene transfer methods- Electroporation, biolystic gene transfer, liposome mediated transfer.

7.2 Vector mediated gene transfer- *Agrobacterium* mediated gene transfer in plants, Ti-plasmid: structure and functions, Ti plasmid based vectors, advantages.

8**. Application of plant genetic engineering in crop improvement.** **4L**

8.1 Introduction

8.2 Insect pest resistance, abiotic stress tolerance, herbicide resistance, storage protein quality

9. **Nano-biotechnology** **2L**

9.1 Definition and concept

9.2 Applications of nanotechnology in agriculture (fertilizers and pesticides).

REFERENCES:

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12. Text book of biotechnology, R.C.Dubey, 2009, S.Chand, Delhi

S. Y. B. Sc. [Botany] Paper III

Practicals Based on Theory Paper I and II

a) Taxonomy of Angiosperms and Plant Community

1. Description of flowering plant in botanical terms (01 P)
2. Study of plant families (any four) (03 P)
3. Study of ecological adaptations in Hydrophytes with any two examples (01P)
4. Study of ecological adaptations in Xerophytes with any two examples (01P)
5. Study of vegetation by list count quadrat method. (01P)
6. Study of tools of taxonomy and ecological instruments (any four each) (01P)

b) Plant Physiology

1. Determine water holding capacity (WHC) and pH of soil (pH by pH meter.) (01 P)
2. Study of plasmolysis in suitable plant material (01 P)
3. Determination of Diffusion Pressure Deficit (DPD). (01 P)
4. Determine rate of transpiration under different conditions of (01 P)
   Sunlight, Shade and wind
5. Demonstration Experiments. (Compulsory Practical) (01 P)
   a. Curling Experiment
   b. Imbibition in seeds
   c. Arc Auxanometer
   d. Effect of auxins on rooting
   e. Transpiration pull
   f. Spectrophotometer
   g. Portable leaf area meter
   h. Conductivity meter
   i. Centrifuge
6. Assessing seed viability by TTC method (01 P)

c) Plant Anatomy and Embryology

1. Study of epidermal tissue system – non-glandular and glandular trichomes, multilayered epidermis, typical stomata (dicot and monocot). (01 P)
2. Study of mechanical tissues and their distribution in root, stem and leaves. (01 P)
3. Study of normal secondary growth in dicot stem – *Annona* /*Moringa*. (01 P)
   (Double stained temporary preparation).

4. Study of anomalous secondary growth in *Bignonia* and *Dracaena* stem. (01 P)
   (Double stained temporary preparation).
5. Study of tetrasporangiate anther and types of ovules. (01 P)
6. Study of dicot and monocot embryo. (01 P)

b) Plant Biotechnology

1. Production of citric acid by *Aspergillus niger* and estimation of citric acid by titration method. (02 P)
2. Production of single cell protein production i.e. *Spirulina* / yeast and study of commercial products (01 P)
3. Demonstration of fermentation and fermentation products (01 P)
4. Demonstration of separation of plasmid DNA by agarose gel electrophoresis (01 P)
5. Demonstration of enzyme immobilization (01 P)

N.B. Botanical excursion tour and submission of at least five correctly identified wild plant photographs is compulsory.