

**Rayat Shikshan Sanstha's**  
**Yashwantrao Chavan Institute of Science,**  
**Satara**  
**(Autonomous)**

**Syllabus under Autonomy**  
**For**  
**B. Sc. I (Botany)**

# Academic Year 2021 – 2022

Rayat Shikshan Sanstha's

**Yashavantrao Chavan Institute of Science, Satara**

**Syllabus for Bachelor of Science (B. Sc.) Part – I**

1. TITLE: Botany

2. YEAR OF IMPLEMENTATION: 2021 – 2022

3. PREAMBLE:

The B. Sc. Botany course under autonomy will be effective from the academic year 2019 – 2020. It has been prepared keeping in view the unique requirements of B. Sc. Botany students. The contents have been drawn up to accommodate the widening horizons of the discipline of biological sciences. The emphasis is to provide students the latest information along with due weightage to the concepts of classical botany so that they are able to understand and appreciate the current interdisciplinary approaches in the study of plant sciences and its role in societal development. The course content also lists new practical exercises so the students get a hands-on experience of the latest techniques that are currently in use. The course will also inspire students to pursue higher studies in botany, for becoming an entrepreneur and enable students to get employed in plant-based industries.

4. GENERAL OBJECTIVES OF THE COURSE:

1. To impart the knowledge of science is the basic objective of education.
2. To develop scientific attitude among the students and to make the students open minded, critical and curious.
3. To develop skill in practical work, experiments and laboratory materials.
4. To understand scientific terms, concepts, facts, phenomenon and their relationships.
5. To make the students aware of natural resource and environment.
6. To enable the students to acquire knowledge of plants and related subjects so as to understand nature and environment in the benefit of human beings.
7. To develop ability for the application of acquired knowledge to improve agriculture and related fields to make the country self-reliant.

5. DURATION: 01 year

6. PATTERN: CBCS Semester

7. MEDIUM OF INSTRUCTION: English

8. STRUCTURE OF COURSE:

1) FIRST SEMESTER (NO. OF PAPERS – 02)

Sr. No.	Subject Title	Theory					Practical	
		Paper No. & Paper Code	Title of Paper	No. of lectures per week	Credits		No. of lectures Per week	Credits

1.	Botany	Paper – I: BBT 101	Biodiversity of Microbes, Algae and Fungi	5	4	Practical Paper – I: BBP 103	4	2
		Paper – II: BBT 102	Plant Ecology					

## 2) SECOND SEMESTER (NO. OF PAPERS – 02)

Sr. No.	Subject Title	Theory					Practical	
		Paper No. & Paper Code	Title of Paper	No. of lectures per week	Credits		No. of lectures Per week	Credits
1.	Botany	Paper-III: BBT 201	Biodiversity of Archegoniate - Bryophytes, Pteridophytes, Gymnosperms	5	4	Practical Paper – I : BBP 203	4	2
		Paper- IV: BBT 202	Plant Taxonomy					

## 2) Structure and titles of papers of B. Sc. Course

### **B. Sc. I Semester I**

Paper I: Biodiversity of Microbes, Algae and Fungi

Paper II: Plant Ecology

Botany Practical I: Practical's based on Theory paper I and II

### **B. Sc. I Semester II**

Paper III: Biodiversity of Archegoniate - Bryophytes, Pteridophytes, Gymnosperms

Paper IV: Plant Taxonomy

Botany Practical II: Practical's based on Theory paper III and IV

## 3) OTHER FEATURES:

### A) LIBRARY:

Reference books, Textbooks, Journal, Periodicals available in Institute and Departmental Library. (Separate reference lists are attached along with the respective course syllabus)

### B) SPECIFIC EQUIPMENTS:

a) Computer, LCD projector, visualizer, smart board

b) Laboratory Equipment's:

- |                                   |                             |
|-----------------------------------|-----------------------------|
| 1. Microscope with digital camera | 2. Digital weighing balance |
| 3. pH meter                       | 4. Microtome                |
| 5. Autoclave                      | 6. Hot Air Oven             |
| 7. Incubator                      | 8. Refrigerator             |

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**Syllabus introduced from June 2019**

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**Bachelor of Science (B. Sc.) Part – I: Botany**

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**Semester I**

**Theory Paper I (BBT 101) Biodiversity of Microbes, Algae and Fungi**

**Learning Objectives:**

1. To impart the basic knowledge of different plant groups.
2. To impart the knowledge of biodiversity of lower plant groups.

**Unit I Introduction to Plant Kingdom and Bacteria (11)**

Systems of classification (Two, Three and Five kingdom systems), General outline of plant kingdom.

Bacteria: Discovery, General characters, Cell structure, Types Modes of reproduction – Vegetative, Asexual, Sexual – Conjugation, Economic Importance.

**Unit II Algae (09)**

General Characters of Algae, Economic importance of Algae, Morphology and life cycles (excluding developmental stages) of *Nostoc* and *Spirogyra*

**Unit III Fungi (09)**

General Characters, Economic importance, Morphology and life cycle (excluding developmental stages) of *Mucor* and *Penicillium*

**Unit IV Lichens (07)**

General characters, Types of Lichens on the basis of thallus morphology, Methods of reproduction, Economic importance of lichens

**References:**

1. The Fungi, Ainsworth GC and AS Sussman, Vols. I, II, III, IV- A and IV-B (Unit III)
2. Introductory Mycology, Alexopoulos CJ (1960) (Unit III)
3. A handbook of Lichens, Awasthi DD (2000) (Unit IV)
4. An Introduction to Fungi, Dube HC, Vikas Publishing House Pvt. Ltd., Delhi (1990) (Unit III, IV)
5. College Botany, Gangulee HS and Kar AK, New Central Book Agency (P) Ltd. Vol. I (1992) (Unit I, III, IV)
6. College Botany, Gangulee HS, Das and Datta, New Central Book Agency (P) Ltd. Vol. II (1992) (Unit I, III, IV)
7. Introductory Phycology, Kumar HD. East Western Press. New Delhi (1990) (Unit II)
8. Textbook of Fungi, Sharma OO (1989) (Unit III)
9. Textbook of Thallophytes, Sharma OP. McGraw Hill Pub. Co. (1992) (Unit II)
10. The Fungi, Sharma PD. Rastogi and Company, Meerut. (1991) (Unit III)

11. Cryptogamic Botany, Smith GM. Vol. I Algae and Fungi. Tata McGraw Hill Publishing Co. New Delhi. (1971) (Unit II)
12. Botany for Degree Students Part I Algae, Vashishtha BR. S. Chand and Company, New Delhi. (1976) (Unit II)
13. Botany for degree students – Fungi, Vashistha BR and Sinha AK, S. Chand and Company, New Delhi. (Unit III)

**Learning Outcomes:**

1. The students should be able to explain features and uses of lower cryptogams.
2. The students should be able to define concepts regarding lower cryptogams.
3. The students should be able to write answers and brief notes about plant diversity of lower cryptogams.

**Theory Paper II (BBT 102) Plant Ecology**

**Learning objectives**

1. To make students aware about the concepts of ecology & advanced environmental science.
2. To understand the inter-relationships between the animate and inanimate world.
3. To make the students aware about phytogeographical zones of India, biodiversity and sustainable development
4. To understand the concept of Bioremediation and its applications.

**Unit 1: Ecological Factors and Adaptations (09)**

Introduction, Definition and Scope of Ecology;

Ecological Factors: Edaphic factors: Soil- Origin and formation, Composition, soil profile.

Climatic factors: Light and Temperature as ecological factors;

Ecological Adaptations: Ecological adaptations in Hydrophytes, Xerophytes, Epiphytes and parasites

**Unit 2: Plant Communities and Succession (09)**

Plant Communities: introduction, general characters, forms and structure, Raunkier's life forms;

Plant Succession: characters, process and types – Hydrosere, Xerosere.

**Unit 3: Ecological pyramids and phytogeography (09)**

Ecological pyramids - Number, Biomass and Energy with suitable example; Biogeochemical cycles - Introduction, Phosphorus and Nitrogen cycle; Phytogeographical regions of India

**Unit 4: Phytoremediation (09)**

Concept and scope; Types of remediation (bioaccumulation, rhizofiltration, rhizoextraction);

Phytoremediation of dyes, chemicals and heavy metals

**Learning outcomes**

1. Student explains the basic terms and issues in the field of ecology and environmental protection.
2. Describes the relations and interactions between biotic and abiotic components of the environment.

3. Presents the causes and consequences of a biological imbalance in the ecosystems.
4. Indicates the need for biological monitoring of the environment and the possibility of using bio-indicators in the assessment of the environment

**References:**

1. Plant Ecology, Ambasht RS (1990) (Unit I)
2. Ecology: The experimental analysis of distribution and abundance, Krens CJ, Harper and Row (1978). (Unit I)
3. Patterns of primary production in the biosphere, Lieth HFW (1978). (Unit I)
4. Fundamentals of Ecology, Agarwal SK (1992). (Unit I, III)
5. The Biosphere, Bradbury IK (1990) (Unit I)
6. Comparative Plant Ecology, Grisms JP et al., (1988). (Unit II)
7. Quantitative and dynamic ecology, Kershaw KS (1964). (Unit II)
8. Concept of ecology, Kormondy EJ (1966). (Unit II)
9. Ecology, Krebs CJ (1978). (Unit II)
10. Manual of plant Ecology, Misra KC (1989). (Unit I, III)
11. Fundamentals of Ecology, Odum EP. 3<sup>rd</sup> Ed. (1996) (Unit I, III)
12. Concept of ecology, Kormondy EJ (1966). (Unit III)
13. Principles of Environment Sciences, Pandeya SC et al., (1963). (Unit IV)
14. Environment and Plant Ecology, Etherington JR (1975). (Unit IV)
15. Fundamentals of Ecology, Odum EP, Barrett GW (2010). 6<sup>th</sup> Ed. (Unit I (Unit IV)

**Practical Paper I (BBP103) Practicals based on Theory Paper I and II**

**Learning Objectives:**

1. To give practical knowledge to students about lower plant groups.
2. To give practical knowledge to students about ecological factors and ecological adaptation in plants.
3. To participate students in experiential learning with these practicals.

**Practicals:**

1. Study of forms of bacteria
2. Study of algae through two representative members *Nostoc* and *Spirogyra*.
3. Study of fungi through two representative members *Mucor* and *Penicillium*.
4. Study of Types of lichens (based on morphology).
5. Study of Meteorological Instruments
6. Study of pH and Water Holding Capacity of different soils.
7. Study of morphological and anatomical adaptations in Hydrophytes - *Hydrilla*, *Eichhornia*.
8. Study of morphological and anatomical adaptations in Xerophytes - *Aloe*, *Nerium*.
9. Study of morphological and anatomical adaptations in Epiphytes (Orchid) and Parasites, (*Cuscuta*).
10. Study of Ecological pyramids based on the field data / given data.

11. Study of Phytogeographical regions of India using standard Maps.
12. Study of plants used in bioremediation.

**Learning Outcome:**

The students shall learn:

1. About general characters of lower plant groups through representative members.
2. Handling of meteorological instruments and edaphic factors.
3. About ecological principles, phytogeographical regions and adaptations in different groups of plants.
4. Use of plants in remediation.

**Books Recommended:**

1. Practical Botany, Bendre A, Rastogi Publications (2010)
2. Modern Practical Botany, Pande BP, Vol. I, S Chand Publishers
3. Modern Practical Botany, Pande BP, Vol. II, S Chand Publishers
4. Practical Botany for Advanced Level and Intermediate Students, Wallis CJ (1966) (5<sup>th</sup> Ed.), William Heinemann Medical Books Ltd.

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**Semester II**

**Theory Paper III (BBT 201) Biodiversity of Archegoniate - Bryophytes, Pteridophytes,  
Gymnosperms**

**Learning Objectives:**

1. To make the students aware about the higher plants.
2. To impart the knowledge of fossil plants.

**Unit I Bryophytes (09)**

General characters, Alteration of Generation, Economic importance, Morphology, anatomy and life cycle (excluding developmental stages) of *Riccia* and *Funaria*

**Unit II: Pteridophytes (09)**

General characters, Economic importance, Morphology, anatomy and life cycles (excluding developmental stages) of Lycopsida – *Selaginella*, Pteropsida – *Pteris*; Heterospory and seed habitat

**Unit II: Gymnosperms (09)**

General characters; Economic importance; Morphology, anatomy and life cycle (excluding developmental stages) of Cycadopsida- *Cycas* (primitive) and Gnetopsida – *Gnetum* (advanced)

**Unit IV: Palaeobotany (09)**

Introduction; Geological time scale; Fossil formation process; Types of fossils – Compression, Impression, Petrification, Pith Cast, Coal balls

**References:**

1. Studies in Pateobotany, Andrews HN (1961) (Unit IV)
2. An Introduction to Pateobotany, Arnold CA (1972) (Unit IV)
3. The Gymnosperms, Bhatnagar SP and Moitra A (1996). (Unit III)
4. Morphology of Vascular plants, Bierhorst DW (1971) (Unit II, III)
5. Gymnosperms, Structure and Evolution, Chamberlein CJ (1966) (Unit III)
6. Morphology of Gymnosperms, Coulter and Chamberlein JM, (Unit III)
7. Principles of Paleobotany, Darroh WC (1960) (Unit IV)
8. Comparative morphology of vascular plants, Foster AS and Gifford EM (1959) (Unit III)
9. The Phylogeny and Classification of ferns, Jermy AG (1973). (Unit II)
10. Liverworts of Western Himalayas and the Punjab Plains Part I and II, Kashyap SR (1929) (Unit I)
11. An Introduction to Pteridophyta, Parihar NS (1959) (Unit II)
12. Bryophyta, Parihar NS., Central Book Depot, Allahabad (1962) (Unit I)
13. Indian Gymnosperms in Time and Space, Ramanujan CGK (1979) (Unit III)
14. An introduction to Peridophytes, Rashid A (1978) (Unit II)



15. Essentials of Paleobotany, Shukla AC and Mishra SD (1975) (Unit IV)
16. Cryptogamic Botany, Smith GM., Vol. II Tata McGraw Hill Publishing Co. New Delhi. (1971) (Unit I)
17. Morphology of Pteridophytes, Spome KR (1966) (Unit II)
18. Morphology of Gymnosperms, Sporne KR (1967) (Unit III)
19. Paleobotany and the evolution of plants, Stewart WN (1983), Cambridge U.S. (Unit IV)
20. Indian Fossil Pteridophytes, Surange KR (1968) (Unit IV)
21. Advances in Pteridology, Trivedi AN (2002) (Unit II)
22. Botany for degree students, Vashishta BR (1996)– Pteridophytes (Unit II)
23. The Gymnosperms, Vashistha PC (1976) (Unit III)
24. The structure and life of Bryophytes, Watson EV., Hutchinson and Co., London (1971) (Unit I)

**Learning Outcomes:**

1. The students should be able to explain features and uses of vascular plants.
2. The students should be able to define concepts regarding vascular plants and fossils.
3. The students should be able to write answers and brief notes about plant diversity of vascular plants.

**Theory Paper IV (BBT 202) Plant Taxonomy**

**Learning Objectives:**

1. To impart the knowledge of basic structures of higher plants.
2. To impart the knowledge of developmental events in plants.

**Unit I: Introductory Taxonomy (09)**

Introduction, Importance of Taxonomy; Functions of taxonomy: Identification, Nomenclature, Binomial Nomenclature, Classification; Salient features of International Code of Botanical Nomenclature (ICBN).

**Unit II: Tools for taxonomic studies (09)**

Herbarium - Introduction, Role and significance.

Botanical Gardens - Introduction, Role and Significance.

Study of Sir J. C. Bose Botanical Garden, Culcutta; Lead Botanical Garden, Shivaji University, Kolhapur.

Taxonomic literature – Flora, Monograph, Revisions

**Unit III: Systems of classification of angiosperms (09)**

General characters; Life cycle pattern in angiosperms;

Systems of classifications:

- 1) Artificial: Theophrastus (370-285 BC), Linnaeus (1707 - 1778)
- 2) Natural: Bentham and Hooker's (1862-83)
- 3) Phylogenetic: Introduction to APG

#### **Unit IV Angiosperm families (09)**

Description of Plants – Vegetative characters and Reproductive characters

Study of Angiosperm families – morphological, floral and distinguishing characters of following families, with plants of economic importance.

i. Fabaceae, ii. Solanaceae, iv. Nyctaginaceae, v. Liliaceae.

#### **References:**

1. An Integrated System of Classification of Flowering Plants, Cronquist A Columbia University Press, New York (1981).
2. The Evolution and Classification of Flowering Plants, Cronquist A (2<sup>nd</sup> edi.) Allen Press, USA (1988).
3. Principles of Angiosperm Taxonomy, Davis PH, Heywood VH Today and Tomorrow Publications, New Delhi (1991).
4. Families of Flowering plants, Hutchinson J (1959). (Unit IV)
5. Taxonomy of Vascular Plants, Lawrence GHM Oxford and IBH Publ. Co. Pvt. Ltd. New Delhi (1951).
6. A Handbook of Taxonomic Training, Manilal KS, Muktesh Kumar MS DST, New Delhi (1998).
7. Taxonomy of Angiosperms, Naik VN Tata McGraw-Hill Publication Com. Ltd. New Delhi (Unit I, II, III) (1984).
8. College Botany Vol. II, Gangulee HS and Kar AK, New Central Book Agency (P) Ltd. (1992) (Unit II, III, IV)
9. College Botany, Pande BP, Vol. II, S Chand Ltd. (2010) (Unit I, II, III, IV)
10. Plant Systematics: An Integrated Approach, Gurucharan Singh, Science Publishers Inc. (2004) (Unit I, II, III, IV)

#### **Learning Outcomes:**

1. The students should be able to explain the concepts of fundamentals of plant sciences.
2. The students should be able to define the characteristic feature of plant development and angiosperm taxonomy.
3. The students should be able to write answers and brief notes about basics of morphology and development in angiosperms.

#### **Practical Paper II (BBP 203) Practical's based on Theory Paper I and II**

#### **Learning Objectives:**

1. To give practical knowledge to students about identification of plants around them.
2. To give the practical knowledge about morphological and anatomical variations in plants.

#### **Practicals**

1. Study of Bryophytes through representative members *Riccia* and *Funaria*
2. Study of Pteridophytes through representative members *Selaginella* and *Pteris*.
3. Study of Gymnosperms through representative members *Cycas* and *Gnetum*.
4. Study of types of fossils (Compression, Impression, Petrification, Cast and Coal Balls).

5. Study of flowering twig morphology - Vegetative characters
6. Study of flowering twig morphology - Floral -/reproductive characters
7. Study of Vegetative and Floral characters of Family Caesalpiniaceae.
8. Study of Vegetative and Floral characters of Family Solanaceae.
9. Study of Vegetative and Floral characters of Family Nyctaginaceae.
10. Study of Vegetative and Floral characters of Family Liliaceae.
11. Study of preparation of herbarium.
12. Study of use of flora for identification of plants.

**Learning Outcome:**

The students shall learn:

1. To study the general characteristics of Archegoniate through representative members.
2. To identify the fossil types.
3. To describe the plants around them.
4. To use taxonomic literature for angiospermic plant identification

**Books Recommended:**

1. Practical Botany, Bendre A, Rastogi Publications (2010)
2. Modern Practical Botany, Pande BP, Vol. I, S Chand Publishers
3. Modern Practical Botany, Pande BP, Vol. II, S Chand Publishers
4. Practical Botany for Advanced Level and Intermediate Students, Wallis CJ (5<sup>th</sup> Ed.), William Heinemann Medical Books Ltd. (1966)