

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
Yashwantrao 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 2021 – 2022. 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 gets 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 COURSES – 02)

Sr. No.	Subject Title	Theory					Practical	
		Course No. & Course Code	Title of Paper	No. of lectures per week	Credits		No. of lectures Per week	Credits
1.	Botany	Course – I: BBT 101	Biodiversity of Microbes, Algae and Fungi	5	4	Practical Paper – I: BBP 103	4	2
		Course – II: BBT 102	Plant Ecology					

2) SECOND SEMESTER (NO. OF COURSES – 02)

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

2) Structure and titles of courses of B. Sc. Curriculum

B. Sc. I Semester I

Course I: Biodiversity of Microbes, Algae and Fungi

Course II: Plant Ecology

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

B. Sc. I Semester II

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

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

Semester I

Theory Course 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.
3. To impart the knowledge of importance of lower plant groups.
4. To impart the knowledge of opportunities for career in uses of lower plant groups.

Unit 1: 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 2: Algae (09)

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

Unit 3: Fungi (09)

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

Unit 4: Lichens (07)

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

References:

1. G. C. Ainsworth, A. S. Sussman and F. K. Sparrow, The Fungi- an advanced treatise, Vols. I-V (New York: Academic Press, 1965)
2. C. J. Alexopoulos, C. W. Mims and M. Blackwell, Introductory Mycology, Fourth Edition (India: Wiley India Pvt. Ltd, 2007)
3. D. D. Awasthi, A Handbook of Lichens (India: Bishen Singh Mahindra Pal Singh, 2000)
4. H. C. Dube, An Introduction to Fungi (Delhi: Vikas Publishing House Pvt. Ltd.,1990)
5. H. S. Gangulee and A. K. Kar, College Botany Vol. I and II (India: New Central Book Agency (P) Ltd.,1992)
6. H. D. Kumar, Introductory Phycology (New Delhi: East Western Press, 1990)
7. O. P. Sharma, Textbook of Fungi (New Delhi: Tata Mc Graw Hill, 1989)
8. O. P. Sharma, Textbook of Thallophytes (New Delhi: Tata Mc Graw Hill, 1992)
9. P. D. Sharma, The Fungi (Meerut: Rastogi and Company, 1991)
10. G. M. Smith, Cryptogamic Botany, Vol. I Algae and Fungi (New Delhi: Tata McGraw Hill Publishing Co., 1971)
11. B. R. Vashishtha, Botany for Degree Students, Part I-Algae (New Delhi: S. Chand and Company, 1976)
12. B. R. Vashishtha, A. K. Sinha and Anil Kumar, Botany for Degree Students- Fungi (New Delhi: S. Chand and Company, 2016)

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.
4. The students should be able to seek career opportunities in academics, research and entrepreneurship with respect to lower cryptogams.

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Semester I

Theory Course 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 living and non- living world.
3. To make the students aware about phytogeographical zones of India, biodiversity and sustainable development.
4. To make the students 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. R. S. Ambasht, A Textbook of Plant Ecology (India: CBS Publishers and Distributors, 2017)
2. C. J. Krens, Ecology: The experimental analysis of distribution and abundance, Third Edition (New York: Harper and Row Publishers, 1985)
3. J. L. Chapman and M. J. Reiss, Ecology: Principles and Applications (Cambridge: Cambridge University Press, 1999)
4. Helmut Lieth and R. H. Whittaker, Patterns of primary production in the biosphere (Berlin, Heidelberg, New York: Springer Verlag, 1975)
5. S. K. Agarwal, Fundamentals of Ecology (New Delhi: APH Publishing Corporation, 2008)
6. E. J. Kormondy, Concepts of Ecology (New Jersey: Prentice Hall Publishing Company, 1996).
7. K. C. Misra, Manual of Plant Ecology (New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd., 1991)
8. E. P. Odum, and G. W. Barrett, Fundamentals of Ecology (California: Thomson Brooks/Cole Publishing, 2005)
9. P. D. Sharma, Ecology and Environment (Meerut: Rastogi Publications, 2007)

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

Semester I

Practical Course 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. A. Bendre, Practical Botany (Meerut: Rastogi Publications, 2010)
2. B. P. Pandey, Modern Practical Botany, Vol. I and II (New Delhi: S Chand and Company Ltd., 1999)

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

Semester II

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

Learning Objectives:

1. To make the students aware about the higher plants and their evolution.
2. To impart the knowledge and importance of fossil plants.
3. To make the students aware of the economic importance of archegoniate.

Unit 1: Bryophytes (09)

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

Unit 2: Pteridophytes (09)

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

Unit 3: Gymnosperms (09)

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

Unit 4: Palaeobotany (09)

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

References:

1. H. N. Andrews, Studies in Palaeobotany (London: John Wiley and Sons, 1967)
2. C. A. Arnold, An Introduction to Palaeobotany (Read Books, 2008)
3. S. P. Bhatnagar and Alok Moitra, Gymnosperms (The New Age International Ltd., 1996)

4. Morphology of Vascular plants, Bierhorst DW (1971) (Unit II, III)
5. C. J. Chamberlain, Gymnosperms, Structure and Evolution (Dover Publications, 1966)
6. K. U. Kramer, P. S. Green and K. Kubitzki, The Families and Genera of Vascular Plants- Vol. I: Pteridophytes and Gymnosperms (Springer Verlag, 2000)
7. A. S. Foster and E. M. Gifford, Comparative Morphology of Vascular Plants (W. H. Freeman Publishers, 1959)
8. N. S. Parihar, An Introduction to Embryophyta: Vol. I Bryophyta (Allahabad: Central Book Depot, 1972)
9. N. S. Parihar, The Biology and Morphology of Pteridophytes (Allahabad: Central Book Publishers, 1996)
10. C. G. K. Ramanujam, Indian Gymnosperms in Time and Space (Today and Tomoorow's Printers and Publishers, 1976)
11. A. Rashid, An Introduction to Pteridophytes- Diversity, Development, Differentiation (Vikas Publishing House, 1999)
12. A. C. Shukla and S. P. Mishra, Essentials of Paleobotany (Vikas Publishing House, 1982)
13. G. M. Smith, Cryptogamic Botany, Vol. II (New Delhi: Tata McGraw Hill Publishing Co. 1971)
14. K. R. Sporne, Morphology of Gymnosperms (Hutchinson Publishers, 1965)
15. K. R. Sporne, Morphology of Pteridophytes (Creative Media partners Ltd, 2018)
16. W. N. Stewart, Paleobotany and the evolution of plants, (USA, Cambridge University Press, 1983)
17. K. R. Surange, Indian Fossil Pteridophytes (New Delhi: CSIR, 1966)
18. B. R. Vashishtha, Botany for degree students Part III- Bryophytes (Delhi, S. Chand and Complany, 1986)
19. P. C. Vashishtha, Pteridophyta- Vascular Cryptogams (Delhi, S. Chand Publications, 1993)
20. P. C. Vashishtha, Botany for Degree Students- The Gymnosperms, (S. Chand and company, 1976)

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.

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Semester II

Theory Course 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.
3. To impart the importance of classification of plants.
4. To make the students aware about the systems of plant classification and the latest rules related to classification.

Unit 1: 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 2: Tools for taxonomic studies

(09)

Herbarium - Introduction, Role and significance.

Botanical Gardens - Introduction, Role and Significance.

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

Taxonomic literature – Flora, Monograph, Revisions

Unit 3: 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 4: 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. A. Cronquist, An Integrated System of Classification of Flowering Plants (New York: Columbia University Press, 1981).
2. A. Cronquist, The Evolution and Classification of Flowering Plants, (2nd edi.) (USA, Allen Press, 1988).
3. P. H. Davis and V. H. Heywood, Principles of Angiosperm Taxonomy (New Delhi, Today and Tomorrow Publications, 1991).
4. John Hutchinson, Families of Flowering Plants (Cleander Press, 1969)
5. Taxonomy of Vascular Plants, Lawrence GHM Oxford and IBH Publ. Co. Pvt. Ltd. New Delhi (1951).
6. K. S. Manilal and Muktesh Kumar, A Handbook of Taxonomic Training (New Delhi: MS-DST, 1998).
7. V. N. Naik, Taxonomy of Angiosperms (New Delhi: Tata McGraw-Hill Publication Com. Ltd., 1984)
8. H. S. Gangulee and A. K. Kar, College Botany Vol. II (New Central Book Agency Pvt. Ltd. 1992)
9. B. P. Pandey, College Botany, Vol. II, (New Delhi, S Chand Ltd., 2010)
10. Gurucharan Singh, Plant Systematics: An Integrated Approach (Science Publishers Inc., 2004)

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.

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Semester II

Practical Course 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. A. Bendre, Practical Botany (Meerut: Rastogi Publications, 2010)
2. B. P. Pandey, Modern Practical Botany, Vol. I and II (New Delhi: S Chand and Company Ltd., 1999)