

**Rayat Shikshan Sanstha's  
Sadguru Gadage Maharaj College,  
Karad  
(Autonomous)**

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

**Academic Year 2019 – 2020**

**Sadguru Gadage Maharaj College, Karad.**

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

1. TITLE: Botany

2. YEAR OF IMPLEMENTATION: 2019 – 2020

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 : BBP103	4	2
		Paper – II: BBT102	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: Practicals 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: Practicals 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 Equipments:

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. Ainsworth GG and AS Sussman, The Fungi Vols. I, II, III, IV- A and IV-B (Unit III)
2. Alexopoulos CJ (1960) Introductory Mycology (Unit III)
3. Awasthi DD (2000) A handbook of Lichens (Unit IV)
4. Dube HC (1990) An Introduction to Fungi, Vikas Publishing House Pvt. Ltd., Delhi (Unit III, IV)
5. Gangulee HS and Kar AK (1992) College Botany Vol. II, New Central Book Agency (P) Ltd. (Unit I, III, IV)
6. Gangulee HS, Das and Datta (1992) College Botany Vol. I, New Central Book Agency (P) Ltd. (Unit I, III, IV)
7. Kumar HD (1990) Introductory Phycology. East Western Press. New Delhi (Unit II)
8. Sharma OO (1989) Textbook of Fungi (Unit III)
9. Sharma OP (1992) Textbook of Thallophytes. McGraw Hill Pub. Co. (Unit II)
10. Sharma PD (1991) The Fungi. Rastogi and Company, Meerut. (Unit III)
11. Smith GM (1971) Cryptogamic Botany. Vol. I Algae and Fungi. Tata McGraw Hill Publishing Co. New Delhi. (Unit II)
12. Vashishtha BR (1976) Botany for Degree Students Part I Algae. S. Chand and Company, New Delhi. (Unit II)
13. Vashistha BR and Sinha AK, Botany for degree students – fungi (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.

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

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**Semester I**

**Theory Paper II (BBT102) 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. Ambasht RS (1990) Plant Ecology (Unit I)
2. Krens CJ, Harper and Row (1978) Ecology: The experimental analysis of distribution and abundance. (Unit I)
3. Lieth HFW (1978) Patterns of primary production in the biosphere. (Unit I)
4. Agarwal SK (1992) Fundamentals of Ecology. (Unit I, III)
5. Bradbury IK (1990) The Biosphere (Unit I)
6. Grisms JP et al., (1988) Comparative Plant Ecology. (Unit II)
7. Kershaw KS (1964) Quantitative and dynamic ecology. (Unit II)
8. Kormondy EJ (1966) Concept of ecology. (Unit II)
9. Krebs CJ (1978) Ecology. (Unit II)
10. Misra KC (1989) Manual of plant Ecology. (Unit I, III)
11. Odum EP (1996) Fundamentals of Ecology. 3<sup>rd</sup> Ed. (Unit I, III)
12. Kormondy EJ (1966) Concept of ecology. (Unit III)
13. Pandeya SC et al., (1963) Principles of Environment Sciences. (Unit IV)
14. Etherington JR (1975) Environment and Plant Ecology. (Unit IV)
15. Odum EP, Barrett GW (2010) Fundamentals of Ecology. 6<sup>th</sup> Ed. (Unit I (Unit IV)



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

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**Semester I**

**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. Bendre A (2010) Practical Botany, Rastogi Publications
2. Pande BP, Modern Practical Botany, Vol. I, S Chand Publishers
3. Pande BP, Modern Practical Botany, Vol. II, S Chand Publishers
4. Wallis CJ (1966) Practical Botany for Advanced Level and Intermediate Students (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 III: Gymnosperms (09)**

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

**Unit IV: Paleobotany (09)**

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

**References:**

1. Andrews HN (1961) Studies in Paleobotany (Unit IV)
2. Arnold CA (1972) An Introduction to Paleobotany (Unit IV)
3. Bhatnagar SP and Moitra A (1996) The Gymnosperms. (Unit III)
4. Bierhorst DW (1971) Morphology of Vascular plants (Unit II, III)
5. Chamberlein CJ (1966) Gymnosperms, Structure and Evolution (Unit III)
6. Coulter and Chamberlein JM, Morphology of Gymnosperms (Unit III)
7. Darroh WC (1960) Principles of Paleobotany (Unit IV)
8. Foster AS and Gifford EM (1959) Comparative morphology of vascular plants (Unit III)
9. Jermy AG (1973) The Phylogeny and Classification of ferns. (Unit II)
10. Kashyap SR (1929) Liverworts of Western Himalayas and the Punjab Plains Part I and II (Unit I)
11. Parihar NS (1959) An Introduction to Pteridophyta (Unit II)
12. Parihar NS (1962) Bryophyta. Central Book Depot, Allahabad (Unit I)
13. Ramanujan CGK (1979) Indian Gymnosperms in Time and Space (Unit III)
14. Rashid A (1978) An introduction to Peridophytes (Unit II)
15. Shukla AC and Mishra SD (1975) Essentiales of Paleobotany (Unit IV)
16. Smith GM (1971) Cryptogamic Botany. Vol. II Tata McGraw Hill Publishing Co. New Delhi. (Unit I)
17. Spome KR (1966) Morphology of Pteridophytes (Unit II)
18. Sporne KR (1967) Morphology of Gymnosperms (Unit III)
19. Stewart WN (1983) Paleobotany and the evolution of plants, Cambridge U.S. (Unit IV)

20. Surange KR (1968) Indian Fossil Pteridophytes (Unit IV)
21. Trivedi AN (2002) Advances in Pteridology (Unit II)
22. Vashishta BR (1996) Botany for degree students – Pteridophytes (Unit II)
23. Vashishta PC (1976) The Gymnosperms (Unit III)
24. Watson EV (1971) The structure and life of Bryophytes. Hutchinson and Co., London (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.

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**Semester II**

**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, Calcutta; Lead Botanical Garden, Shivaji University, Kolhapur.

Taxonomic literature – Flora, monograph

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

General characters; Life cycle pattern in angiosperms;

Systems of classifications – Natural, Artificial and Phylogenetic;

Bentham and Hooker's System of classification

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

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



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**Semester II**

**Practical Paper II (BBP 203) Practicals based on Theory Paper III and IV**

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