



Syllabus
First Semester Courses in
BSc
Botany
(June 2023 onwards)

- Core Courses:
 - USBOT4501CR1 Plant Morphology and Anatomy
 - USBOT4501CR1PR Plant Morphology and Anatomy Practical

- Vocational Skill Course:
 - USBOT4501VS1 Botanic Gardens

- Evaluation and Assessment guidelines

APPROVED SYLLABUS



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FYBSc in Botany		
Course Title: Plant Morphology and Anatomy		
Course Code: USBOT4501CR1		
Credits 4: Theory (3) = 45 hrs and Practical (1) = 30 hrs		
No.	Course Objectives	
1.	Understand the morphological peculiarities of plant organs.	
2.	Learn the plant taxonomical terminologies and understand the meaning of the same.	
3.	Observe and distinguish different tissues in plants.	
4.	Study the primary structures in plants.	
CO	Course Outcomes On completing the course, the learner will be able to	Bloom's Taxonomy Level (BT level)
1.	Learn the various terms required to technically describe the plant, and the use of specific characters in identifying plant families.	Remembering
2.	Comprehend the anatomy of dicot and monocot root, stem and leaf.	Understanding
3.	Know how anatomy helps to understand the simple and compound tissues in plants.	Applying
4.	Analyze the morphological differences in root, stem, leaves, inflorescence, flowers, their different parts, and modifications of structure.	Analyzing

UNIT I Morphology of vegetative organs 15 L

1. Morphology of Root and its modifications. (03)
2. Morphology of Stem and its modifications. (04)
3. Morphology of Leaf and its modifications. (08)

UNIT II Morphology of reproductive organs 15 L

1. Inflorescence: Types of inflorescences in plants. (06)
2. Flower: Calyx, corolla, androecium and gynoecium. (09)



UNIT III Anatomy 15 L

1. Tissue systems in plants: Epidermal, ground and vascular tissue systems. (04)
2. Simple and compound tissues: Parenchyma, collenchyma, sclerenchyma, xylem and phloem. (05)
3. Study of primary structures: Dicot and monocot root, stem and leaf. (06)

Reference Books:

1. Dutta, A. C. (1976). A Classbook of Botany; 15th edition; Calcutta: Oxford University Press.
2. Eames, Arthur J.; MacDaniels, Laurence H. (2004) An introduction to plant anatomy; 2nd edition.; New Delhi: Tata Mcgraw-Hill Publishing Company Limited.
3. Esau, Katherine, (1977). Anatomy of seed plants; 2nd edition; New York: John Wiley & Sons.
4. Foster, Adriance, (2022). Practical Plant Anatomy, Legare Street Press.
5. Lawrence, George H. M. (1967). Taxonomy of Vascular Plants; 1st edition; New Delhi: Oxford & IBH Publishing Co.
6. Sharma, Rajni., (2004). An Introduction to Plant Anatomy, 1st edition, Campus Books International.
7. Sinha, R. K. (2021). Practical Taxonomy of Angiosperms, 2nd edition, Dreamtech Press,
8. Sivarajan, V. V. (1991). Introduction to the principles of plant taxonomy; 2nd edition; Cambridge: Cambridge University Press.
9. Subrahmanyam, N. S. (1995). Modern plant taxonomy; New Delhi: 1st edition; Vikas Publishing House Pvt. Ltd.

Evaluation (Core Theory, USBOT4501CR1): Total marks per course - 100.

- I. Formative Assessment 'for' Learning
(continuous internal assessment - CIA to improve learning).
CIA- 40 marks
CIA 1: Written test -20 marks
CIA 2: Test / Assignment / Quiz -20 marks
- II. Summative Assessment 'of' Learning
(focus on outcomes, quantitative data for outcomes of instruction).
End Semester Examination – 60 marks
One question from each unit for 20 marks, with internal choice.
Total marks per question with choice -28 to 30.

Distribution of Bloom's Taxonomy levels for the course assessment

Learning Levels	Remember	Understand	Apply	Analyze
*Percentage	30-40%	30-40%	20-30%	20-30%



FYBSc in Botany		
Course Title: Plant Morphology and Anatomy Practical		
Course Code: USBOT4501CR1PR		
Credit(s) 1: = 30 hrs		
No.	Course Objectives	
1.	Learn to identify and describe plant parts.	
2.	Acquire skills in using microscopes for observation.	
3.	Observe plant tissues and understand their functions.	
4.	Examine internal structures of dicot and monocot plants.	
5.	Explore and classify epidermal outgrowths.	
6.	Investigate stomata in plants for insights into gas exchange.	
CO	Course Outcomes On completing the course, the learner will be able to	Bloom's Taxonomy Level (BT level)
1.	Recognize and articulate the morphological features of roots, stems, leaves, inflorescences, and flowers. Skillfully handle and maintain simple and compound microscopes for specimen examination.	Apply
2.	Prepare and analyze transverse sections of dicot and monocot roots, stems, and leaves to understand their anatomical differences.	Analyze
3.	Utilize light microscopy to examine and interpret plant tissue structures. Identify various epidermal outgrowths and understand their ecological roles and functions.	Evaluate
4.	Mount and study the structure and distribution of stomata in dicot and monocot plants.	Create

S. No. Name of Practical

1. Study of morphological characters of root, stem, leaf, inflorescence and flower.
2. Handling of simple and compound microscopes.
3. Study of tissue structures using a light microscope.
4. Take transverse section dicot and monocot root, stem and leaf to study its anatomy.
5. Study of Epidermal outgrowths in plants.
6. Mounting and study of dicot and monocot stomata.



Evaluation (Practical, USBOT4501CR1PR): Total marks practical course - 50

CIA - 20 marks

End Semester Practical Examination - 30 marks.

Continuous practical evaluation will be done on the basis on the completion of the hands-on practical sessions

Distribution of Bloom's Taxonomy levels for the practical assessment

Learning Levels	Remember	Understand	Apply	Analyze	Evaluate	Create
*Percentage	25-30%	15-20%	15-20%	15-20%	15-20%	10-15%



FYBSc in Botany		
Course Title: Botanic Gardens		
Course Code: USBOT4501VS1		
Credits 4: Theory (1) = 15 hrs and Practical (1) = 30 hrs		
No.	Course Objectives	
1. 2. 3. 4. 5. 6. 7.	Understand the historical development and evolution of botanical gardens worldwide. Study the role of botanical gardens in conservation efforts, including the preservation of endangered plant species. Examine the design and layout of botanical gardens, including plant classification systems and plant collections. Apply knowledge acquired in the course through hands-on activities, such as plant propagation, gardening techniques, and participation in citizen science projects. Identify plants using key morphological traits. Map plant diversity in an area. Use digital tools for ecological studies. Analyze tree life cycle data. Observe diverse plant species during field trip. Learn about plant conservation and ecology	
CO	Course Outcomes On completing the course, the learner will be able to	Bloom's Taxonomy Level (BT level)
1.	Learn historical significance of botanical gardens, including their role in conservation, education, and research.	Remembering
2.	Understand the fundamental concepts and principles of botanical gardens.	Understanding
3.	Develop skills in identifying and classifying various plant species found in botanical gardens.	Applying
4.	Use the principles of plant ecology and conservation practices in botanical gardens, for the preservation of endangered plant species and habitats. Observe plant diversity during botanical visit, and Recognize importance of conservation.	Analyzing
5.	Utilize Google Earth for mapping.	Evaluate
6.	Understand ecosystem and climate impacts. Collect and interpret phenology data, and analyze plant diversity data.	Create



UNIT I Botanic Gardens	15 L
A. Introduction	
1. Botanical Garden - Introduction and History.	(01)
2. Role of botanical gardens in Taxonomic Studies, Research & conservation, endangered plant species and habitat preservation.	(02)
3. Basic requirements of botanical gardens, types of botanical gardens, ex-situ conservation methods.	(02)
4. Major Botanical Gardens of India, Royal Botanic Gardens, Kew.	(02)
B. Plant data collection and identification	
1. Citizen science projects and data collection.	(01)
2. Basic plant identification techniques.	(03)
3. Taxonomic classification systems.	(02)
4. Botanic Gardens Conservation International (BGCI).	(02)

Reference Books:

1. Bhattacharya B. (2009). Systematic Botany. 2nd Ed., Narosa Publishing House.
2. Mondal A.K. (2005). Advance plant Taxonomy. New Central Book Agency (P) Ltd.
3. Pandey B.P. (2012). A textbook of Botany Angiosperms. S. Chand and Company Ltd.
4. Singh Gurucharan, (2010). Plant Systematics – Theory and Practice 3rd edition.
5. Subrahmanyam, N. S. (1995). Modern plant taxonomy; New Delhi: 1st edition; Vikas Publishing House Pvt. Ltd.

S. No. Name of Practical

1. Study of morphology of leaf and flower parts.
2. Study of Plant identification techniques.
3. Preparation of diversity map for a given plant for a given area using Google earth.
4. Study of tree phenology data.
5. Field trip to a botanical garden.



Evaluation (Theory and Practical, USBOT4501VS1): Total marks per course – 50

Formative Assessment 'for' Learning

(continuous internal assessment - CIA to improve learning- practical).

CIA - 20 marks (Practical portion)

CIA 1: Test (Practical) - 10 marks.

CIA 2: Assignment / as prescribed (Practical) - 10 marks.

Summative Assessment 'of' Learning

(focus on outcomes, quantitative data for outcomes of instruction)

End Semester Examination (Theory portion) - 30 marks

Distribution of Bloom's Taxonomy levels for the course assessment

Learning Levels	Remember	Understand	Apply	Analyze	Evaluate	Create
*Percentage	20-30%	25-30%	15-20%	15-20%	10-20%	5-10%





Syllabus

First Semester Courses in Botany

(June 2023 onwards)

- Open Elective Courses:
 - USBOT4501OE1 Gardening
 - USBOT4502OE1 Plants in Human Nutrition
- Evaluation and Assessment Guidelines




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FYBA, FYBMS, FYMCJ, FYBAF, FYBCom		
Course Title: Gardening		
Course Code: USBOT4501OE1		
Credits 2: Theory (2) = 30 hrs		
No.	Course Objectives	
1.	Introduce students to the fundamental principles of gardening, including plant selection, soil preparation, and garden design.	
2.	Develop students' understanding of plant care techniques, such as watering, fertilizing, and pest control.	
3.	Provide hands-on experience in cultivating different types of plants, including flowers, vegetables, and herbs.	
4.	Familiarize students with sustainable gardening practices, such as composting, organic gardening methods, and water conservation.	
CO	Course Outcomes On completing the course, the learner will be able to	Bloom's Taxonomy Level (BT level)
1.	Learn the history, definition, objectives and scope of gardening.	Remembering
2.	Demonstrate an understanding of the basic principles of gardening, including plant selection, soil preparation, and garden layout.	Understanding
3.	Apply appropriate plant care techniques, such as watering, fertilizing, and pest management, to maintain healthy and thriving plants.	Applying
4.	Implement sustainable gardening practices, such as composting, organic pest control, and water-efficient irrigation techniques.	Analyzing
5.	Cultivate a variety of plants, including flowers, vegetables, and herbs, using proper planting methods and maintenance practices.	Evaluating
6.	Design and create aesthetically pleasing gardens, considering factors such as color harmony, plant placement, and focal points.	Creating



UNIT I Basics of gardening 15 L

1. Introduction: History of gardening, definition, objectives and scope. (04)
2. Types of Gardening: Different types of gardening, home gardening, parks and its components - plant materials and design. (07)
3. Organic Farming: Definition, scope, Indian scenario, and future scope. (04)

UNIT II Techniques in gardening 15 L

1. Soil selection, preparation and plantation: Selection of site. Preparation of soils for garden- mulching, top-dressing, blanching. Sowing, transplanting, tree transplanting. Irrigation- overhead, surface, and underground. Weeding and pruning- principles, objectives and general technique. (08)
2. Cultivation of vegetables: Study of cultivation of different vegetables for home garden: cabbage, brinjal, lady's finger, onion, garlic, tomatoes, and carrots. Storage and marketing procedures. (07)

Reference Books:

1. Breck, J. (2023). *The Flower-Garden*. BoD-Books on Demand.
2. Bose T.K., Mukherjee, D. (1972). *Gardening in India*, New Delhi, Delhi: Oxford & IBH Publishing Co.
3. Jules, J. (1979). *Horticultural Science*, 3rd edition, San Francisco, California: W.H. Freeman and Co.
4. Kumar, N. (1997). *Introduction to Horticulture*. Nagercoil, Tamil Nadu: Rajalakshmi Publication
5. Weiner, A. (2022). Introduction: landscaping the human garden. In *Landscaping the Human Garden* (pp. 1-1). Stanford University Press.



Evaluation (Theory, USBOT4501OE1): Total marks per course – 50

Formative Assessment 'for' Learning

(continuous internal assessment - CIA to improve learning).

CIA - 20 marks

CIA 1: Written test - 10 marks.

CIA 2: Test / Assignment / Presentations / Infographics / Quiz / as prescribed - 10 marks.

Summative Assessment 'of' Learning

(focus on outcomes, quantitative data for outcomes of instruction)

End Semester Examination - 30 marks

One question from each unit for 15 marks, with internal choice.

Total marks per question with choice 10 - 15 marks.

Distribution of Bloom's Taxonomy levels for the course assessment

Learning Levels	Remember	Understand	Apply	Analyze	Evaluate	Create
*Percentage	10-25%	15-20%	20-30%	10-20%	10-20%	5-10%



FYBA, FYBMS, FYMCJ, FYBAF, FYBCom		
Course Title: Plants in Human Nutrition		
Course Code: USBOT4502OE1		
Credits 2: Theory (2) = 30 hrs		
No.	Course Objectives	
1.	Make the students familiar with the nutritional importance of diverse plants.	
2.	Clarify the plant sources for carbohydrates, fats, proteins, vitamins, minerals and fibres.	
3.	Connect the nutrients in plants with human health, prevention of chronic diseases, and supplements of specific nutrients	
4.	Generate interest in plants, its conservation, and sustainability.	
CO	Course Outcomes On completing the course, the learner will be able to	Bloom's Taxonomy Level (BT level)
1.	Perceive the significance of plants in maintaining good health, preventing common diseases, fulfilling nutritional deficiencies and in reducing the risk of chronic diseases.	Remembering
2.	Comprehend the components of a nutritional healthy diet.	Understanding
3.	Appreciate the value of plants in one's diet.	Applying
4.	Discern healthy eating with sustainability.	Analyzing
5.	Recognize our dependency on edible plants and its implications on ecology, economics and society.	Evaluating



UNIT I Major plant groups in nutrition 15 L

1. **Cereals, Legumes and cash crops:** Wheat and rice, economics and uses. A (08) brief account of millets and their nutritional importance, (Jowar). General account, (Chickpea). Cash crops: sugarcane and its benefits
2. **Spices, fruits, beverages, oils and fats:** Importance of spices, (clove). Citrus (07) fruits; beverages: tea and coffee; General description, uses and health implications of safflower oil, and Groundnut.

UNIT II Sustainable use of plants in nutrition 15 L

1. **Functional foods:** Introduction, importance of *Moringa*, coconut oil as (09) functional foods. Drug-yielding plants: therapeutic and habit-forming drugs with special reference to *Aloe vera* and *Cannabis*. Dietary-fibers containing plants: oats, fruits, vegetables, and root tubers.
2. **Diet, biodiversity and implications:** Concept of a nutritionally healthy diet, (06) sustainable diets, and biodiversity; ecological, economic, and social implications of man's dependency on edible plants in light of threats to plants and their native habitats.

Reference Books:

1. Chrispeels, M.J. and Sadava, D.E. (1994). Plants, Genes and Agriculture. Jones & Bartlett Publishers.
2. Gopalan C, Rama Sastri B V, Balasubramanian S C, Narasinga Rao B S, Deosthale Y G, Pant K C, (2004). Nutritive value of Indian foods. National Institute of Nutrition, ICMR, Hyderabad, India, Revised edition.
3. Kochhar, S. L. (2012). Economic Botany in Tropics. New Delhi, India: MacMillan & Co
4. Mitra Debabrata, Guha Jibes, Chaudhuri Salil Kumar, (1990). Studies in Botany Vol-II, Moulik Library, Calcutta, 5th revised edition.
5. Pandey B P, Economic Botany, S. Chand & Company, New Delhi, 5th revised edition, 1995.
6. Wickens, G.E. (2001). Economic Botany: Principles & Practices. The Netherlands: Kluwer Academic Publishers.



Evaluation (Theory, USBOT4502OE1): Total marks per course – 50

Formative Assessment 'for' Learning

(continuous internal assessment - CIA to improve learning).

CIA - 20 marks

CIA 1: Written test - 10 marks.

CIA 2: Test / Assignment / Presentations / Infographics / Quiz / as prescribed - 10 marks.

Summative Assessment 'of' Learning

(focus on outcomes, quantitative data for outcomes of instruction)

End Semester Examination - 30 marks

One question from each unit for 15 marks, with internal choice.

Total marks per question with choice 10 - 15 marks.

Distribution of Bloom's Taxonomy levels for the course assessment

Learning Levels	Remember	Understand	Apply	Analyze	Evaluate	Create
*Percentage	20-25%	20-25%	10-15%	10-15%	10-15%	03-05%





Syllabus
First Semester Course in
BSc
Botany
(June 2023 onwards)

- Skill Enhancement Course:
 - **USBOT4501SE1 Biofertilizers**
- Evaluation and Assessment guidelines



APPROVED SYLLABUS

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FYBSc		
Course Title: Biofertilizers		
Course Code: USBOT4501SE1		
Credits (2): Theory (1) = 15 hrs and Practical (1) = 30 hrs		
No.	Course Objectives	
1.	Explore the mechanisms by which bio-fertilizers enhance plant growth, including nutrient cycling, disease suppression, and improved soil structure.	
2.	Familiarize students with the methods of production, formulation, and application of biofertilizers in various agricultural systems.	
3.	Discuss the environmental benefits of using biofertilizers, such as reduced chemical fertilizer usage, minimized nutrient runoff, and improved soil health.	
4.	Perform the pour plate technique to isolate <i>Rhizobium</i> from root nodules. Utilize the enrichment culture technique for the selective growth of <i>Rhizobium</i> species.	
5.	Understand the ISI standards specified for biofertilizer quality. Develop skills to estimate the viable bacterial count in carrier-based biofertilizers.	
CO	Course Outcomes On completing the course, the learner will be able to	Bloom's Taxonomy Level (BT level)
1.	Explain the mechanisms by which biofertilizers contribute to plant growth and soil fertility improvement.	Remembering
2.	Understand the principles and importance of biofertilizers in sustainable agriculture.	Understanding
3.	Gain hands-on experience with the equipment, machinery, and tools essential for the production of biofertilizers.	Applying
4.	Perform various quality control tests for biofertilizers, ensuring the reliability and effectiveness of the biofertilizer products.	Analyzing
5.	Estimate the efficiency of <i>Rhizobium</i> through pot culture experiments and nodulation tests in test tubes and Leonard jars.	Evaluate
6.	Select and prepare appropriate media for the cultivation of biofertilizer organisms, understanding the nutritional and environmental requirements for optimal growth.	Create



UNIT I Biofertilizers **15 L**

A. Introduction, classification and growth

1. Biofertilizers: Introduction, types, history, and importance in agriculture and organic farming system. (02)
2. Classification of microorganisms used in biofertilizers production. (01)
3. Growth characteristics of various microbes used in biofertilizers production. (02)

B. Nitrogen Fixation

1. Nitrogen cycle in nature and its importance. (02)
2. Process of nodule formation, role of Nif and Nod gene in biological nitrogen fixation, enzyme nitrogenase and its components. Biochemistry of nitrogen fixation. (02)
3. Cross inoculation groups amongst *Rhizobium*. Methods used for the studying selection of efficient strains of *Rhizobium*. (02)

C. Quality and Production

1. Quality standard for biofertilizers different methods of application of biofertilizers, role of microorganisms in decomposition of organic farm wastes, methods of quality control assessment in respect of biofertilizers. (03)
2. Strategies of Mass multiplication and packing. Registration of biofertilizers. (01)

Reference Books:

1. Dubey, R.C. (2005). A Textbook of Biotechnology. New Delhi, Delhi: S. Chand & Co.
2. Kumaresan, V. (2005). Biotechnology. New Delhi, Delhi: Saras Publication.
3. John Jothi Prakash, E. (2004). Outlines of Plant Biotechnology. New Delhi, Delhi: Emkay Publication.
4. Sathe, T.V. (2004). Vermiculture and Organic Farming. New Delhi, Delhi: Daya publishers.
5. Subha Rao, N.S. (2000). Soil Microbiology. New Delhi, Delhi: Oxford & IBH Publishers.
6. Vayas, S. C, Vayas, S., Modi, H.A. (1998). Bio-fertilizers and organic Farming. Nadiad, Gujarat: Akta Prakashan



S. No. Name of Practical

1. Equipment, machinery and tools used for biofertilizers.
2. Media used for biofertilizers.
3. Isolation of *Rhizobium* from root nodules by a) Pour plate technique b) Enrichment culture technique.
4. Estimating the efficiency of *Rhizobium* through pot culture experiments and through nodulation tests in test tubes and Leonard jar.
5. Methods of application of biofertilizers.
6. Quality control of biofertilizers: ISI standards specified and estimating the viable bacterial count in carrier based biofertilizers.
7. Quality control tests for biofertilizers.

Evaluation (Theory and Practical, USBOT4501SE1): Total marks per course – 50

Formative Assessment 'for' Learning

(continuous internal assessment - CIA to improve learning- practical).

CIA - 20 marks (Practical portion)

CIA 1: Test (Practical) - 10 marks.

CIA 2: Assignment / as prescribed (Practical) - 10 marks.

Summative Assessment 'of' Learning

(focus on outcomes, quantitative data for outcomes of instruction)

End Semester Examination (Theory portion) - 30 marks

Distribution of Bloom's Taxonomy levels for the course assessment

Learning Levels	Remember	Understand	Apply	Analyze	Evaluate	Create
*Percentage	20-25%	15-20%	20-25%	10-20%	10-20%	5-10%

