



**Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science & Commerce,
Baramati
(Empowered Autonomous)**

Three/Four Year Honours/ Honours with Research B. Sc. Degree

Program in Botany

(Faculty of Science)

CBCS Syllabus

S. Y. B. Sc. (Botany) Semester - III

for Department of Botany

NEP 2.0

Choice Based Credit System Syllabus (2024 Pattern)

(As Per NEP 2020)

To be implemented from Academic Year 2025-2026

Title of the Programme: S.Y. B. Sc. (Botany)

Preamble

AES's Tuljaram Chaturchand College of Arts, Science and Commerce (Autonomous) has decided to change the syllabus of various faculties from June, 2023 by taking into consideration the guidelines and provisions given in National Education Policy (NEP), 2020. The NEP envisions making education more holistic and effective and to lay emphasis on the integration of general (academic) education, vocational education and experiential learning. The NEP introduces holistic and multidisciplinary education that would help to develop intellectual, scientific, social, physical, emotional, ethical and moral capacities of the students. The NEP 2020 envisages flexible curricular structures and learning based outcome approach for the development of the students. The credit structure and courses framework provided in the NEP are nationally accepted and internationally comparable.

The rapid changes in science and technology and new approaches in different areas of Botany and related subjects, the Board of Studies in Botany at Tuljaram Chaturchand College, Baramati - Pune, has prepared the syllabus of F.Y. B.Sc. Botany Sem. I and II the Choice Based Credit System (CBCS) by following the guidelines of NEP 2020, NCeF, NHEQF, Prof. R.D. Kulkarni's Report, GR of Government of Maharashtra dated 20th April, 16th May 2023 and 13th March 2024 and the Circular of SPPU, Pune dated 31st May 2023 and 2nd May, 2024.

A Botany degree equips students with the knowledge and skills necessary for a diverse range of fulfilling career paths. Graduates in Botany find opportunities in various fields, including urban planning, teaching, environmental science, all plant sciences, organic farming, nursery management, entrepreneurship, mushroom cultivation, medicinal plant, floriculture, horticulture, propagation methods and plant tissue culture method and many other domains. Throughout their three year degree program, students explore the significance of plant in life of each and every living organism on Earth. They learn tool, techniques, process which is required to set up agencies including pickles, jam, and jelly, medicinal plant, fruit processing, vegetable processing, organic product, organic fertilizer and pesticides producing industries also they can earn the knowledge to produce natural remedies for various diseases. They became expert in discovery and development of many new therapeutic compounds which are now used in pharmaceutical herbal cosmetics and other compound based industries.

Overall, revising the Botany syllabi in accordance with the NEP 2020 ensures that students receive an education that is relevant, comprehensive, and prepares them to navigate the dynamic and interconnected world of today.

It equips them with the knowledge, skills, and competencies needed to contribute meaningfully to society and pursue their academic and professional goals in a rapidly changing global landscape.

Programme Specific Outcomes (PSOs)

PSO1. Knowledge and understanding of: 1.The range of plant diversity in terms of structure, anatomy, function and environmental relationships. 2. The evaluation of plant diversity. 3. Identification and classification and the flora of Maharashtra.

4. The role of plants in the functioning of the global ecosystem. 5. A selection of more specialized, optional topics. 6. Application of Statistics to solve biological problem.

PSO2. Intellectual skills – able to: 1. Think logically and organize tasks into a structured form. 2. Assimilate knowledge and ideas based on wide reading and through the internet. 3. Transfer of appropriate knowledge and methods from one concept to another within the subject. 4. Understand the evolving state of knowledge in a rapidly developing research field. 5. Construct and test hypothesis. 6. Plan, conduct and write a report on an independent term project.

PSO3. Practical skills: Students learn to carry out practical work, in the field and in the laboratory, with minimal risk. They gain introductory experience in applying each of the following skills and gain greater proficiency in a selection of them depending on their choice of optional modules. 1. Interpreting plant morphology and anatomy. 2. Plant identification. 3. Vegetation study techniques. 4. Analysis of chemical compounds in plant materials in the context of plant physiology and biochemistry. 5. Analyze data using appropriate statistical methods and computational packages. 6. Plant pathology to be added for lab to land farm.

PSO4. Transferable skills: 1. Use of IT (word-processing, use of internet, statistical packages and databases). 2. Communication of scientific ideas in writing and orally. 3. Ability to co-ordinate as part of team. 4. Ability to use library resources. 5. Time

PSO5. Scientific Knowledge: Apply the knowledge of basic plant science, life sciences and fundamental process of plants to study and analyze any plant form.

PSO6. Problem analysis: Identify the taxonomic position of plants, formulate the research literature and analyze PET structure and non-reported plants with substantiated conclusions using first principles and methods of nomenclature and classification in Botany.

PSO7. Design/development of solutions: Design solutions from medicinal plants to solve health problems, disorders and disease of human beings and animals estimate the phytochemical content of plants which fulfil the specified needs to appropriate consideration for the public and animal health.

PSO8. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and development of the information to provide scientific conclusions.

PSO9. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern instruments and equipments for Biochemical estimation, Molecular Biology, Biotechnology, Bioinformatics, Biophysics, Biostatistics, Plant Tissue culture experiments, cellular and physiological activities of plants with an understanding of the application and

PSO10. The Botanist and society: Apply reasoning informed by the contextual knowledge to assess plant diversity, its importance for society, health, safety, legal and environmental issues and the consequent responsibilities relevant to the biodiversity conservation practice.

PSO11. Environment and sustainability: Understand the impact of the plant diversity in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable agricultural and environmental development.

PSO12. Ethics: Apply ethical principles and commit to environmental ethics and responsibilities and norms of the biodiversity conservation.

PSO13. Individual and team work: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary task settings.

PSO14. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and intertie effective reports and design documentation, make effective presentations and give and receive clear instructions.

PSO15. Project management and finance: Apply knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team to manage projects and in eco-friendly environments.

PSO16. Life-long learning: Identify the necessities and have the preparation and ability to engage in independent and life-long learning in the broadest context of upcoming advanced technology.

Course Structure (2024 Pattern)

Course Structure for F.Y. B. Sc. Botany Semester I and II (2024 Pattern)

Sem.	Course Type	Course Code	Course Title	Theory / Practical	Credits
I	DSC-I (General)	-101-GEN		T	02
		-102-GEN		P	02
	DSC-II (General)	-101-GEN		T	02
		-102-GEN		P	02
	DSC-III (General)	BOT-101-GEN	Plant Diversity	T	02
		BOT-102-GEN	Botany Practical - I	P	02
	Open Elective (OE)	BOT-103-OE	Horticulture	T	02
	Skill Enhancement Course (SEC)	BOT-104-SEC	Fruit Processing Industries	P	02
	Ability Enhancement Course (AEC)	ENG-104-AEC		T	02
	Value Education Course (VEC)	ENV-105-VEC		T	02
	Generic Indian Knowledge System (GIKS)	GEN-106-IKS		T	02
	Total Credits Semester-I				22
II	DSC-I (General)	-151-GEN		T	02
		-152-GEN		P	02
	DSC-II (General)	-151-GEN		T	02
		-152-GEN		P	02
	DSC-III (General)	BOT-151-GEN	Industrial Botany	T	02
		BOT-152-GEN	Botany Practical - II	P	02
	Open Elective (OE)	BOT-153-OE	Floriculture	P	02
	Skill Enhancement Course (SEC)	BOT-154-SEC	Mushroom Cultivation	P	02
	Ability Enhancement Course (AEC)	ENG-154-AEC		T	02
	Value Education Course (VEC)	COS-155-VEC		T	02
	Co-curricular Course (CC)	YOG/PES/CUL/NS S/NCC-156-CC	To be selected from the CC Basket	T	02
	Total Credits Semester-II				22
	Cumulative Credits Semester I + Semester II				44

Department of Botany
Course Structure for S. Y. B. Sc. Sem. III and IV (2024 Pattern) as per NEP 2020

Sem.	Course Type	Course Code	Course Title	Theory/ Practical	Credits
III	Major Mandatory	BOT-201-MRM	Taxonomy of Angiosperm	Theory	02
	Major Mandatory	BOT-202-MRM	Plant Physiology	Theory	02
	Major Mandatory	BOT-203-MRM	Botany Practical - I	Practical	02
	Vocational Skill Course (VSC)	BOT-204-VSC	Practical based on Herbal Cosmetics	Practical	02
	Feld Project (FP)	BOT-205-FP	Field Project	Practical	02
	Minor	BOT-206-MN	Floriculture	Theory	02
	Minor	BOT-207-MN	Practical based on Floriculture	Practical	02
	Open Elective (OE)	BOT-208-OE	Economic Botany	Theory	02
	Subject Specific Indian Knowledge System (IKS)	BOT-209-IKS	Botany in Ayurveda	Theory	02
	Ability Enhancement Course (AEC)	MAR-210-AEC/ HIN-210-AEC/ SAN-210-AEC	-	Theory (Any one)	02
	Co-curricular Course (CC)	YOG/PES/CUL/ NSS/ NCC-211-CC	To be continue from the Semester - II	-	02
Total Credits Semester - III					22
IV	Major Mandatory	BOT-251-MRM	Plant Anatomy	Theory	02
	Major Mandatory	BOT-252-MRM	Plant Ecology	Theory	02
	Major Mandatory	BOT-253-MRM	Botany Practical - II	Practical	02
	Vocational Skill Course (VSC)	BOT-254-VSC	Herbal Cosmetics	Theory	02
	Community Engagement Project (CEP)	BOT-255-CEP	Community Engagement Project	Practical	02
	Minor	BOT-256-MN	Industrial Botany	Theory	02
	Minor	BOT-257-MN	Practical based on Industrial Botany	Practical	02
	Open Elective (OE)	BOT-258-OE	Practical based on Horticulture	Practical	02
	Skill Enhancement Course (SEC)	BOT-259-SEC	Practical based on Floriculture	Practical	02
	Ability Enhancement Course (AEC)	MAR-260-AEC/ HIN-260-AEC/ SAN-260-AEC	-	Theory (Any one)	02
	Co-curricular Course (CC)	YOG/PES/CUL/ NSS/ NCC-261-CC	To be continue from the Semester - III	-	02
Total Credits Semester - IV					22
Total Credits Semester II + IV					44

Department of Botany S. Y. B.Sc. Semester- IV

Name of the Programme	:	B. Sc. Botany
Programme Code	:	USBT
Class	:	S.Y.B.Sc.
Semester	:	IV
Course Type	:	Major Mandatory (Theory)
Course Code	:	BOT-251-MRM
Course Title	:	Plant Anatomy
No. of Credits	:	02
No. of Teaching Hours	:	30

A) Course Objectives:

1. To introduce students with internal structure of plant and its organs.
2. To study importance and scope of plant anatomy.
3. To study different tissues present in plant.
4. To study tissue systems in plant.
5. To study normal secondary growth in plants.
6. To give knowledge of importance of cambium in secondary growth.
7. To study abnormal secondary growth and its causes.

B) Course Outcome:

By the end of the course, students will be able to:

- CO1. Describe internal structure of plant and its organs.
- CO2. Get knowledge of importance and scope of plant anatomy.
- CO3. Get knowledge of different tissues present in plant.
- CO4. Get knowledge of tissue systems in plants.
- CO5. Get knowledge of normal secondary growth in plants.
- CO6. Get knowledge of importance of cambium in secondary growth.
- CO7. Get knowledge of abnormal secondary growth and its causes.

Credit- I

Unit - 1 **(15L)**

- 1.1 Plant Anatomy:** Introduction, Definition, scope of plant anatomy and types of tissues. 2L
- 1.2 Epidermal tissue system:** Structure and function of epidermal tissue system, uniseriate and multiseriate epidermis, Stomata: structure, types and functions, epidermal outgrowths: glandular and non-glandular trichomes. 4L
- 1.3 Mechanical tissue system:** 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. 5L
- 1.4 Vascular tissue system:** Structure and function of xylem, phloem and cambium, Types of vascular bundles. 4L

Credit- II

Unit - 2 **(15L)**

- 2.1 Meristematic tissue system:** Structure and function of meristematic tissue system, Types of meristems. 3L
- 2.2 Normal secondary growth :** Introduction, cambium and its role in secondary growth,

Department of Botany S. Y. B.Sc. Semester- IV

process of secondary growth in stems of *Helianthus annuus*, extrastelar and intrastelar secondary growth, annual rings, periderm, bark, tylosis and lenticels. 7L

2.3 Anomalous secondary growth: Introduction, causes or reasons of anomalous secondary growth, anomalous secondary growth in dicot stem (*Bignonia*) and dicot root (*Raphanus*) and monocot stem (*Dracaena*). 6L

References

1. Chandurkar, P. J. (1971). *Plant anatomy*. Oxford and IBH Publishing Co.
2. Pandey, B. P. (1987). *Plant anatomy*. S. Chand and Company Ltd.
3. Eames, A. J., & McDaniel, V. (1990). *An introduction to plant anatomy*. McGraw-Hill Book Co. Ltd. and Kogakusha Co.
4. Foster, A. S. (2000). *Practical plant anatomy*. D. Van Nostrand Co. Inc.
5. Esau, K. (2000). *Plant anatomy*. Wiley-Toppan Co.
6. Roy, P. (2004). *Plant anatomy*. New Central Book Agency Ltd.

Choice Based Credit System Syllabus (2024 Pattern) Mapping of Program Outcomes with Course Outcomes

Class : S.Y. B. Sc. (Sem. IV)

Subject : Botany

Course: Plant Anatomy

Course Code : BOT-251-MRM

Weightage: 1= Weak or low relation, 2= Moderate or Partial relation, 3= Strong or direct relation

	Programme Outcomes (POs)												
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO 1	3	3								3			
CO 2	3		3			2							2
CO 3	2	3					3	3	2				
CO 4	2	2					3	3	2				
CO 5	3			2			2	2	3				
CO 6	2						2					3	
CO 7	3	2		3	2		2	2	3		2		

Justification for the mapping

PO1. Comprehensive Knowledge and Understanding

CO1. Describe internal structure of plant and its organs.

CO2. Get knowledge of importance and scope of plant anatomy.

CO3. Get knowledge of different tissues present in plant.

CO4. Get knowledge of tissue systems in plants.

CO5. Get knowledge of normal secondary growth in plants.

CO6. Get knowledge of importance of cambium in secondary growth.

CO7. Get knowledge of abnormal secondary growth and its causes.

PO2. Practical, Professional, and Procedural Knowledge

CO1. Describe internal structure of plant and its organs.

CO3. Get knowledge of different tissues present in plant.

CO4. Get knowledge of tissue systems in plants.

CO7. Get knowledge of abnormal secondary growth and its causes.

PO3. Entrepreneurial Mindset and Knowledge

CO2. Get knowledge of importance and scope of plant anatomy.

PO4. Specialized Skills and Competencies

CO5. Get knowledge of normal secondary growth in plants.

CO7. Get knowledge of abnormal secondary growth and its causes.

PO5. Capacity for Application, Problem-Solving, and Analytical Reasoning

CO7. Get knowledge of abnormal secondary growth and its causes.

PO6. Communication Skills and Collaboration

CO2. Get knowledge of importance and scope of plant anatomy.

PO7. Research-related Skills

CO3. Get knowledge of different tissues present in plant.

CO4. Get knowledge of tissue systems in plants.

CO5. Get knowledge of normal secondary growth in plants.

CO6. Get knowledge of importance of cambium in secondary growth.

CO7. Get knowledge of abnormal secondary growth and its causes.

PO8. Learning How to Learn Skills

CO3. Get knowledge of different tissues present in plant.

CO4. Get knowledge of tissue systems in plants.

CO5. Get knowledge of normal secondary growth in plants.

CO7. Get knowledge of abnormal secondary growth and its causes.

PO9. Digital and Technological Skills

CO3. Get knowledge of different tissues present in plant.

CO4. Get knowledge of tissue systems in plants.

CO5. Get knowledge of normal secondary growth in plants.

CO7. Get knowledge of abnormal secondary growth and its causes.

PO10 Multicultural Competence, Inclusive Spirit, and Empathy

CO1. Describe internal structure of plant and its organs.

PO11. Value Inculcation and Environmental Awareness

CO7. Get knowledge of abnormal secondary growth and its causes.

PO12 Autonomy, Responsibility, and Accountability

CO6. Get knowledge of importance of cambium in secondary growth.

PO13. Community Engagement and Service

CO2. Get knowledge of importance and scope of plant anatomy.

Department of Botany S. Y. B.Sc. Semester- IV

Name of the Programme	:	B.Sc. Botany
Program Code	:	USBT
Class	:	S. Y. B. Sc.
Semester	:	IV
Course Type	:	Major Mandatory (Theory)
Course Code	:	BOT-252-MRM
Course Title	:	Plant Ecology
No. of Credits	:	02
No. of Teaching Hours	:	30

A) Course Objective:

1. To understand the concepts of plant ecology.
2. To impart ecosystem dynamics.
3. To study plant-environment interactions.
4. To explore plant communities and biodiversity.
5. To knowledge about ecological adaptations and ecological successions.
6. To understand human impact on plant ecology.
7. To promote environmental awareness and conservation ethics.

B) Course Outcome:

By the end of the course, students will be able to:

- CO1. Understanding of basic ecological principles, including ecosystem structure, function and energy flow.
- CO2. Assess the structure, composition, and dynamics of plant communities.
- CO3. Demonstrate the ability to identify factors that influence plant diversity and distribution within various ecosystems.
- CO4. Understand the role of plants in ecosystem processes such as primary production and nutrient cycling.
- CO5. Gain insight into key ecological processes, including plant population regulation, competition, herbivory and mutualism.
- CO6. Critically evaluate the impact of human activities on plant communities and ecosystems.
- CO7. Demonstrate the ability to apply ecological concepts to real-world environmental problems, such as conservation of endangered species, habitat restoration, and sustainable land use practices.

Credit-I **(15L)**

Unit-1

- 1.1. Introduction of plant ecology:** 2L
Introduction, Concept, definition, autecology and synecology, applications of plant ecology.
- 1.2 Ecosystem ecology:** 6L
Introduction, ecological organization, concept of population, community, ecosystem and biosphere.
- 1.3 Kinds of ecosystem** – Natural and artificial, terrestrial and aquatic-fresh (lotic/lentic), marine ecosystem.
- 1.4 Components of ecosystem**– Biotic and Abiotic components.
- 1.5 Ecosystem dynamics** – Food chain, food web and ecological pyramids
- 1.6. Biogeochemical cycles** – Carbon, nitrogen and phosphorous.
- 1.7 Population and Community ecology:** 4L

Population – Concept, definition, characteristics- size, density, distribution, age structure, reproductive base and ecotypes.

Community – Concept, definition, characteristics- structure, dominance, diversity, periodicity, stratification, ecotone and edge structure.

1.8 Biodiversity and its conservation: 3L

Concept and definition of biodiversity. Methods of biodiversity conservation: *Ex-situ* and *In-situ*. Social approaches in biodiversity conservation- Sacred groves, Chipko movement.

Credit-II (15L)

Unit- 2

2.1 Ecological adaptations: 3L

Adaptive features of plants - external and internal.

Classification of plants and their characteristics–hydrophytes, mesophytes and xerophytes.

2.2 Ecological succession: 4L

Introduction, concept, definition, Principles, Types– primary and secondary.

Hydrosere, xerosere and climax community.

2.3 Man and Environment: 4L

Environmental toxicology-Eutrophication, Bio-accumulation and Bio-magnifications.

Environmental Crisis - Desertification, Ozone depletion and Global warming.

2.4 Environmental Impact Assessment and Environmental audit 4L

EIA-concept, definition, objectives, methodology, applications.

Environmental Audit- concept, definition, need, methodology, certification.

References:

1. Reddy, M. A. (2006). *Textbook of remote sensing and GIS* (3rd ed.). BS Publications.
2. Joseph, G. (2005). *Fundamentals of remote sensing* (2nd ed.). Universities Press (India) Pvt. Ltd.
3. Jensen, J. R. (2000). *Remote sensing of the environment*. Dorling Kindersley India Pvt. Ltd.
4. *Remote sensing for national development* [Special issue]. (1991). *Current Science*, 61(3–4).
5. Canter, L. W. (n.d.). *Environmental impact assessment*. McGraw-Hill Book Company.
6. Rau, G. J., & Weeten, C. D. (1980). *Environmental impact analysis handbook*. McGraw-Hill.
7. Odum, E. P. (1996). *Fundamentals of ecology*. Natraj Publishing.
8. Daubenmire, R. F. (1974). *Plants and environment: A textbook of plant ecology* (3rd ed.). John Wiley & Sons.
9. Kendeigh, S. C. (1980). *Ecology with special reference to animals and man*. Prentice-Hall of India Pvt. Ltd.
10. Kumar, H. D. (1996). *Modern concepts of ecology* (3rd ed.). Vikas Publishing House Pvt. Ltd.
11. Kumar, H. D. (1997). *General ecology*. Vikas Publishing Pvt. Ltd.
12. Kormondy, E. J. (1996). *Concepts of ecology*. Prentice-Hall of India Pvt. Ltd.
13. Smith, R. L. (1996). *Ecology and field biology* (5th ed.). HarperCollins College Publishers.
14. Weaver, J. E., & Clements, S. E. (1966). *Plant ecology*. Tata McGraw-Hill Publishing Co. Ltd.

15. Smith, R. L., & Smith, T. M. (1998). *Elements of ecology* (4th ed.). Addison Wesley Longman Inc.

Choice Based Credit System Syllabus (2024 Pattern)
Mapping of Program Outcomes with Course Outcomes

Class : S.Y. B. Sc. (Sem. IV)

Subject : Botany

Course: Plant Ecology

Course Code : BOT-252-MRM

Weightage: 1= Weak or low relation, 2= Moderate or Partial relation, 3= Strong or direct relation

	Programme Outcomes (POs)												
Course Outcomes	PO 1	PO 2	PO3	PO4	PO 5	PO 6	PO7	PO 8	PO 9	PO 10	PO11	PO 12	PO 13
CO1	3		1				1		1	1	2		1
CO2		2		2	2	1		1				1	
CO3	3						1				2		
CO4		2	1	2	3	1		1	1	1			1
CO5	3			2							2	1	
CO6		2				2			1	1			
CO7			1					1				2	3

Justification for the mapping

PO.1 Comprehensive Knowledge and Understanding:

CO1. Understanding of basic ecological principles, including ecosystem structure, function and energy flow.

CO3. Demonstrate the ability to identify factors that influence plant diversity and distribution within various ecosystems.

CO5. Gain insight into key ecological processes, including plant population regulation, competition, herbivory and mutualism.

PO2. Practical, Professional, and Procedural Knowledge:

CO2. Assess the structure, composition, and dynamics of plant communities.

CO4. Understand the role of plants in ecosystem processes such as primary production and nutrient cycling.

CO6. Critically evaluate the impact of human activities on plant communities and ecosystems.

PO3. Entrepreneurial Mindset and Knowledge:

CO1. Understanding of basic ecological principles, including ecosystem structure, function and energy flow.

CO4. Understand the role of plants in ecosystem processes such as primary production and nutrient cycling.

CO7. Demonstrate the ability to apply ecological concepts to real-world environmental problems, such as conservation of endangered species, habitat restoration, and sustainable land use practices.

PO4. Specialized Skills and Competencies:

CO2. Assess the structure, composition, and dynamics of plant communities.

CO4. Understand the role of plants in ecosystem processes such as primary production and nutrient cycling.

CO5. Gain insight into key ecological processes, including plant population regulation, competition, herbivory, and mutualism.

PO5.Capacity for Application, Problem-Solving, and Analytical Reasoning:

CO2. Assess the structure, composition, and dynamics of plant communities.

CO4. Understand the role of plants in ecosystem processes such as primary production and

nutrient cycling.

PO6. Communication Skills and Collaboration:

CO2. Assess the structure, composition, and dynamics of plant communities.

CO4. Understand the role of plants in ecosystem processes such as primary production and nutrient cycling.

CO6. Critically evaluate the impact of human activities on plant communities and ecosystems.

PO7. Research-related Skills:

CO1. Understanding of basic ecological principles, including ecosystem structure, function and energy flow.

CO3. Demonstrate the ability to identify factors that influence plant diversity and distribution within various ecosystems.

PO8. Learning How to Learn Skills:

CO2. Assess the structure, composition, and dynamics of plant communities.

CO4. Understand the role of plants in ecosystem processes such as primary production and nutrient cycling.

CO7. Demonstrate the ability to apply ecological concepts to real-world environmental problems, such as conservation of endangered species, habitat restoration, and sustainable land use practices.

PO9. Digital and Technological Skills:

CO1. Understanding of basic ecological principles, including ecosystem structure, function and energy flow.

CO4. Understand the role of plants in ecosystem processes such as primary production and nutrient cycling.

CO6. Critically evaluate the impact of human activities on plant communities and ecosystems.

PO10. Multicultural Competence, Inclusive Spirit, and Empathy

CO1. Understanding of basic ecological principles, including ecosystem structure, function and energy flow.

CO4. Understand the role of plants in ecosystem processes such as primary production and nutrient cycling.

CO6. Critically evaluate the impact of human activities on plant communities and ecosystems.

PO11. Value Inculcation and Environmental Awareness:

CO1. Understanding of basic ecological principles, including ecosystem structure, function and energy flow.

CO3. Demonstrate the ability to identify factors that influence plant diversity and distribution within various ecosystems.

CO5. Gain insight into key ecological processes, including plant population regulation, competition, herbivory, and mutualism.

PO12. Autonomy, Responsibility, and Accountability:

CO2. Assess the structure, composition, and dynamics of plant communities.

CO5. Gain insight into key ecological processes, including plant population regulation, competition, herbivory, and mutualism.

CO7. Demonstrate the ability to apply ecological concepts to real-world environmental problems, such as conservation of endangered species, habitat restoration, and sustainable land use practices.

PO13. Community Engagement and Service:

CO1. Understanding of basic ecological principles, including ecosystem structure, function and energy flow.

CO4. Understand the role of plants in ecosystem processes such as primary production and nutrient cycling.

CO7. Demonstrate the ability to apply ecological concepts to real-world environmental problems, such as conservation of endangered species, habitat restoration, and sustainable land use practices.

Name of the Programme	:	B. Sc. Botany
Programme Code	:	USBT
Class	:	S.Y. B. Sc.
Semester	:	IV
Course Type	:	Major Mandatory (Practical)
Course Code	:	BOT-253-MRM
Course Title	:	Practical – II
No. of Credits	:	02
No. of Teaching Hours	:	60

A) Course Objectives:

1. To study internal morphology of plant.
2. To study different tissue systems in plant.
3. To study normal and abnormal secondary growth in plant.
4. To study types of vegetation.
5. To study ecological adaptations in plants.
6. To make students expertise in sectioning and staining technique.
7. Acquaint students with GPS technology.

B) Course Outcome:

By the end of the course, students will be able to:

- CO1. Know internal morphology of plant.
CO2. Students get knowledge of different tissue systems in plant.
CO3. Students learnt normal and abnormal secondary growth in plant.
CO4. Students learnt types of vegetation.
CO5. Students get knowledge of ecological adaptations in plants.
CO6. Students are expertise in sectioning and staining technique
CO7. Students get expertise in GPS technology.

Practicals

- 1) Study of epidermal tissue system: non-glandular and glandular trichomes, multilayered epidermis, typical dicot and monocot stomata.
- 2) Study of mechanical tissues and their distribution in plants.
- 3) Study of Meristems in plants.
- 4) Study of vascular bundles in plants.
- 5) Study of normal secondary growth in dicot stem: *Annona* and *Moringa*.
- 6) Study of anomalous secondary growth in *Bignonia* and *Dracaena* stem.
- 7) Study of tetrasporangiate anther and types of ovules.
- 8) Study of dicot and monocot embryo.
- 9) Vegetation study by list count quadrat method.
- 10) Study of Hydrophytes.
- 11) Study of Xerophytes.
- 12) Study of Ecological instruments.
- 13) Determination of organic carbon in soil by titration method.
- 14) Interpretation of data using satellite imageries.
- 15) Visit to any aquatic / terrestrial ecosystem.

Choice Based Credit System Syllabus (2023 Pattern)
Mapping of Program Outcomes with Course Outcomes

Class : S.Y. B. Sc. (Sem. IV)

Subject : Botany

Course: Practical – II

Course Code : BOT-253-MRM

Weightage: 1= Weak or low relation, 2= Moderate or Partial relation, 3= Strong or direct relation

	Programme Outcomes (POs)												
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO9	PO10	PO11	PO12	PO13
CO 1	3				3								
CO 2	2				2								
CO 3	3				3								
CO 4	3												
CO 5	2												
CO 6	2	3	2	2			3	3	3				
CO 7	2	3	2	2		3	2	2	2		3		3

Justification for the mapping

PO1. Comprehensive Knowledge and Understanding

CO1. Know internal morphology of plant

CO2. Students get knowledge of different tissue systems in plant.

CO3. Students learnt normal and abnormal secondary growth in plant.

CO4. Students learnt types of vegetation.

CO5. Students get knowledge of ecological adaptations in plants.

CO6. Students are expertise in sectioning and staining technique

CO7. Students get expertise in GPS technology.

PO2. Practical, Professional, and Procedural Knowledge

CO6. Students are expertise in sectioning and staining technique

CO7. Students get expertise in GPS technology.

PO3. Entrepreneurial Mindset and Knowledge

CO6. Students are expertise in sectioning and staining technique

CO7. Students get expertise in GPS technology.

PO4. Specialized Skills and Competencies

CO6. Students are expertise in sectioning and staining technique

CO7. Students get expertise in GPS technology.

PO5. Capacity for Application, Problem-Solving, and Analytical Reasoning

CO1. Know internal morphology of plant.

CO2. Students get knowledge of different tissue systems in plant.

CO3. Students learnt normal and abnormal secondary growth in plant.

PO6. Communication Skills and Collaboration

CO7. Students get expertise in GPS technology.

PO7. Research-related Skills

CO6. Students are expertise in sectioning and staining technique

CO7. Students get expertise in GPS technology.

PO8. Learning How to Learn Skills

CO6. Students are expertise in sectioning and staining technique

CO7. Students get expertise in GPS technology.

PO9. Digital and Technological Skills

CO6. Students are expertise in sectioning and staining technique

Name of the Programme	:	B. Sc. Botany
Program Code	:	USBOT
Class	:	S.Y.B.Sc.
Semester	:	IV
Course Type	:	Vocational Skill course, VSC (Theory)
Course Code	:	BOT-221-VSC
Course Title	:	Herbal Cosmetics
No. of Credits	:	02
No. of Teaching Hours	:	30

A) Course Objectives:

1. To understand the concept of herbal cosmetics.
2. To explore the classification and categories of herbal cosmetics
3. To gain insights into the historical development of herbal cosmetics.
4. To explore plants utilized in the formulation of hair care products.
5. To examine the properties of these plants and their efficacy in hair care.
6. To acquire practical knowledge in the preparation of various skin care products.
7. To understand the formulation processes and techniques.

B) Course Outcomes:

By the end of the course, students will be able to:

- CO1. Develop a comprehensive understanding of herbal cosmetics and their classification.
- CO2. Analyze the historical evolution of herbal cosmetics and its impact on the modern industry.
- CO3. Evaluate the differences between herbal and synthetic cosmetic products, recognizing the benefits of herbal alternatives.
- CO4. Demonstrate proficiency in selecting and handling raw materials, machinery, and equipment for herbal cosmetic preparation.
- CO5. Apply knowledge of specific plants in formulating effective skin and hair care products.
- CO6. Overcome challenges associated with the formulation of herbal cosmetics.
- CO7. Gain practical skills in the preparation of a variety of herbal cosmetic products, enhancing hands-on expertise in the field.

Credit: I

Unit: 1 (15L)

- 1.1 Herbal cosmetics:** Definition, scope and importance of cosmetics. Concept of herbal cosmetics – advantages and growing demand. Classification and categories of herbal cosmetics (skin care, hair care, oral care, etc.). Brief history and development of herbal cosmetics in India and worldwide. 4L
- 1.2 Herbal and Synthetic cosmetics:** Difference between herbal and synthetic cosmetics. Benefits and limitations of herbal cosmetics. Challenges in formulating herbal cosmetic products (stability, standardization, preservation, etc.). Safety, quality control and regulatory aspects of herbal cosmetics. 6L
- 1.3 Sources and Selection of Raw Materials:** Sources and selection of raw materials used in herbal cosmetics: Natural ingredients: oils, waxes, gums, resins, clays, essential oils, and herbal extracts. Additives: preservatives, natural colors and fragrances. 3L
- 1.4 Machineries and equipments used in the manufacture of herbal cosmetics:** Mixers, homogenizers, grinders, filters, filling machines and packaging equipment. 2L

Credit-II

Unit: 2

(15L)

- 2.1 Herbal Skin Care Products:** Herbal plants used in skin care formulations like scrubs, 'ubtan', face packs, creams, moisturizers, toners, and sunscreens. Examples: *Aloe vera* (Aloe), *Curcuma longa* (Turmeric), *Azadirachta indica* (Neem), *Ocimum sanctum* (Tulsi), *Santalum album* (Sandalwood), *Rosa indica* (Rose), *Cucumis sativus* (Cucumber) and *Citrus limon* (Lemon). 2L
- 2.2 Hair Care Products:** Herbal plants used in hair oil, shampoo, conditioner and hair tonic. Examples: *Emblica officinalis* (Amla), *Hibiscus rosa-sinensis*, *Eclipta alba* (Bhringraj), *Trigonella foenum-graecum* (Methi), *Lawsonia inermis* (Henna), *Aloe vera*. 3L
- 2.3 Organic Skin Care Products:** Preparation and formulation principles of: Scrubs, Face packs, Vanishing cream, Face wash, Soap, Moisturizer, Talcum powder, Sunscreen. 6L
- 2.4 Preparation and formulations of Herbal Hair Care Products:** Shampoo, Hair oil, Hair conditioners, Hair dye. 4L

References:

- Sharma, P.P. (2018). *Cosmetics: Formulation, Manufacturing and Quality Control*. Vandana Publications.
- Trease, G.E. and Evans, W.C. (2017). *Pharmacognosy*. Saunders.
- Kamboj, V.P. (2000). *Herbal Medicine*. Current Science, 78(1), 35–39.
- Kokate, C.K., Purohit, A.P., & Gokhale, S.B. (2020). *Pharmacognosy*. Nirali Prakashan.
- Pandey, S.N. (2014). *Herbal Cosmetics and Cosmeceuticals*. CBS Publishers & Distributors.

Choice Based Credit System Syllabus (2024 Pattern)
Mapping of Program Outcomes with Course Outcomes

Class : S.Y. B. Sc. (Sem. IV)

Subject : Botany

Course: Herbal Cosmetics

Course Code : BOT-221-VSC

Weightage: 1= Weak or low relation, 2= Moderate or Partial relation, 3= Strong or direct relation

	Programme outcomes (POs)												
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	03												
CO2							02						
CO3				03									
CO4		03											
CO5				03									
CO6						02							
CO7			03										

Justification for the mapping

PO1: Comprehensive Knowledge and Understanding:

CO1. Developing a comprehensive understanding of herbal cosmetics and their classification.

PO2: Practical, Professional, and Procedural Knowledge:

CO4. Demonstrating proficiency in selecting and handling raw materials, machinery and equipment for herbal cosmetic preparation.

PO3: Entrepreneurial Mindset and Knowledge:

CO7. Gaining practical skills in the preparation of a variety of herbal cosmetic products and enhancing hands-on expertise in the field demonstrates effective citizenship and ethics.

PO4: Specialized Skills and Competencies:

CO3. Evaluate the differences between herbal and synthetic cosmetic products, recognizing the benefits of herbal alternatives.

CO5. Apply knowledge of specific plants in formulating effective skin and hair care products.

PO6: Communication Skills and Collaboration:

CO6. Overcome challenges associated with the formulation of herbal cosmetics.

Department of Botany S. Y. B.Sc. Semester- IV

Name of the Programme	:	B.Sc. Botany
Program Code	:	USBT
Class	:	S.Y.B.Sc.
Semester	:	IV
Course Type	:	Community Engagement Project - Practical
Course Code	:	BOT-255-CEP
Course Title	:	Community Engagement Project
No. of Credits	:	02
No. of Teaching Hours	:	60

A) Learning Objectives:

1. To understand the role of botany in community development.
2. To identify local plant species and their significance in the community.
3. To develop skills in conducting botanical surveys and research.
4. To analyze the impact of plants on local ecosystems and communities.
5. To collaborate with community members on sustainable plant-based projects.
6. To promote awareness about the conservation of local flora.
7. To prepare a comprehensive report on the findings and outcomes of the project.

B) Learning Outcomes:

By the end of the course, students will be able to:

- CO1. Understand the role of botany in community development.
CO2. Identify and document local plant species and their significance.
CO3. Conduct botanical surveys and research within the community.
CO4. Analyze and interpret the impact of plants on local ecosystems.
CO5. Work collaboratively with the community on sustainable projects.
CO6. Promote and educate others about the importance of conserving local flora.
CO7. Prepare and present a detailed report on the community engagement project.

Credit I

Unit-1

(30L)

Topic selection, Study design, Survey preparation, Field work, Analysis.

Credit I

Unit-2

(30L)

Report writing and Oral presentation based on Community Engagement Project work.

Choice Based Credit System Syllabus (2024 Pattern)
Mapping of Program Outcomes with Course Outcomes

Class : S.Y. B. Sc. (Sem. IV)

Subject : Botany

Course: Herbal Cosmetics

Course Code : BOT-221-VSC

Weightage: 1= Weak or low relation, 2= Moderate or Partial relation, 3= Strong or direct relation

	Programme Outcomes (POs)												
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PO13
CO1	03												03
CO2				03							02		
CO3		03					03						
CO4	02				03								
CO5			02			03							
CO6						03					03		
CO7								02	02			02	

Justification for the mapping

PO.1 Comprehensive Knowledge and Understanding:

CO1: Understand the role of botany in community development.

CO4: Analyse and interpret the impact of plants on local ecosystems.

PO2. Practical, Professional, and Procedural Knowledge:

CO3: Conduct botanical surveys and research within the community.

PO3. Entrepreneurial Mind-set and Knowledge:

CO5: Work collaboratively with the community on sustainable projects.

PO4. Specialized Skills and Competencies:

CO2: Identify and document local plant species and their significance.

PO5. Capacity for Application, Problem-Solving, and Analytical Reasoning:

CO4: Analyse and interpret the impact of plants on local ecosystems.

PO6. Communication Skills and Collaboration:

CO5: Work collaboratively with the community on sustainable projects.

PO7. Research-related Skills:

CO3: Conduct botanical surveys and research within the community.

PO8. Learning How to Learn Skills:

CO7: Prepare and present a detailed report on the community engagement project.

PO9. Digital and Technological Skills:

CO7: Prepare and present a detailed report on the community engagement project.

PO11. Value Inculcation and Environmental Awareness:

CO2: Identify and document local plant species and their significance.

CO6: Promote and educate others about the importance of conserving local flora.

PO12. Autonomy, Responsibility, and Accountability:

CO7: Prepare and present a detailed report on the community engagement project.

PO13. Community Engagement and Service:

CO1: Understand the role of botany in community development.

Standard Operating Protocols for Community Engagement Project (CEP)

UG (Year-II Semester-IV)

In NEP 2020 (2023 Pattern) we are offering to UG (Second Year- Fourth Semester) students **Community Engagement Project (CEP)** for **TWO (2)** credits i.e. **50 Marks**. The total time allocation for the student to carryout Community Engagement Projects **60 hours**. The actual field works hold be carried out after college hours or on holidays.

1. **Community-Based Learning:** Students should participate in community-based field projects under the supervision of faculty.
2. **Learning Hours Requirement:** A minimum of 30 hours of learning per credit in a semester is required.
3. **Assignment of Project Topics:** Project topics should be assigned to individual students or groups of students (2 or 3 students in one group. One faculty member from the department will act as a GUIDE for the student or group of students.
4. **Preparation of Questionnaire:** Students should prepare a questionnaire (20-30 questions or more) related to their project topic in Marathi or English. If the project is related to work that does not involve SURVEY work, then the questionnaire part can be replaced accordingly.
5. **Finalization of Questionnaire:** The departmental coordinator/guide should review and finalize the questionnaire. Questions that may create unnecessary complications should be avoided. The questions should be both qualitative and quantitative.
6. **Field Data Collection:** Students should visit their chosen field with the questionnaire and collect information regarding the questions from the concerned people. Collect as much information as possible by gathering 25 or more questionnaires or related data. The more data collected, the better it will be for analysis.
7. **Data Compilation and Analysis:** Students should compile all relevant data and carry out its analysis.
8. **Project Report Writing:** Write a project report in the standard format (2 Copies): Index, Chapter-1, Chapter-2, Conclusion, References, etc. The report should clearly mention the output derived from the study. The typed project report should have a minimum of 25 pages, with a font size of 12 and line spacing of 1.5.
9. **Submission of Project Report:** Submit the project report with the Guide's signature to the department (to the Departmental CEP Coordinator).
10. **Oral Presentation:** The department should arrange an oral presentation for all projects. To evaluate the project, TWO examiners should be appointed by the HoD (details about the appointment of examiners, weightage to internal and external marks, etc., will be provided by the examination section).
11. **Project Evaluation:** The total project work, including preparation of the questionnaire to the oral presentation, should be evaluated for 2 credits (50 Marks). The details about the allocation of time, marks, and the scheme of examination for the Community Engagement Project are given in the Table. The departmental CEP coordinator/HoD should submit the marks as per the regular procedure to the examination section.
12. **Compulsory Subject:** Since this is a compulsory subject in our syllabus, passing the Community Engagement Project is a MUST to complete the degree.

Typical Time and marks allocation for the different stages of the Community Engagement Project

Step of Project	Individual students work in hours	Marks
Topic Selection/ Study Design	05	05
Survey preparation / Fieldwork	25	20
Analysis	10	05
Report writing	20	10
Oral Presentation		10
Total	60	50

Department of Botany S. Y. B.Sc. Semester- IV

Name of the Programme	:	B. Sc. Botany
Programme Code	:	USBT
Class	:	S. Y. B. Sc.
Semester	:	IV
Course Type	:	Minor (Theory)
Course Code	:	BOT-256-MN
Course Title	:	Industrial Botany
No. of Credits	:	02
No. of Teaching Hours	:	30

A) Course Objectives:

1. Use of recent techniques.
2. Knowledge of Industrial Crop
3. Crop Management and Agronomy.
4. Exploring the economic significance of Industrial Crops.
5. Processing and Utilization of Industrial Crops.
6. Sustainable uses of techniques.
7. Industrial applications of techniques.

B) Course Outcomes:

By the end of the course, students will be able to:

- CO1. Understand the role of Botany in community development.
CO2. Identify and document local plant species and their significance.
CO3. Conduct botanical surveys and research within the community.
CO4. Analyze and interpret the impact of plants on local ecosystems.
CO5. Work collaboratively with the community on sustainable projects.
CO6. Promote and educate others about the importance of conserving local flora.
CO7. Prepare and present a detailed report on the community engagement project.

Credit-I (15L)

Unit-1

1.1 Soil-less Farming Techniques:

Hydroponics: History and origin of soil less culture, its advantages and disadvantages
Techniques: Nutrient Film Technique (NFT), Passive sub-irrigation, Ebb and flow or flood and rain irrigation, Run to waste, Deep water culture, Bubbleponics, Media used for Hydroponics

1.2 Aeroponics: Introduction, Concept, Types commercial application. 2L

1.3 Gardening: Nursery tools and techniques. Definition, Principles, objectives and scope of garden designing. Different types of gardening – Terrace / Vertical/ rock garden/ /bottle.

Indoor gardening: Bonsai, Terrarium, dish, Kokedama, Hugelkultur. 8L

Credit- II (15L)

Unit-2

2.1 Post-Harvest Technology: Introduction, Need and Scope 1L

2.2 Post-harvest operations: Primary operation: Harvesting, Handling, cleaning, grading and sorting, milling, size reduction, storage and Transportation. 2L

2.3. Secondary Operation: extraction, blending, freezing, chilling, dehydration, canning, thermal processing, Pickling, fermentation, salting. 5L

2.4 Canning and packaging. 2L

2.5 Introduction to cosmetics and personal care Plant based ingredient, Extraction and formulation of plant based products for skin care, hair care and fragrance. 5L

References:

1. Champ, B. R., Highley, E., & Johnson, G. I. (Eds.). (n.d.). *Post-harvest handling of tropical fruit*. Australian Centre for International Agricultural Research.
2. Verma, L. R., & Joshi, V. K. (n.d.). *Post-harvest technology of fruits and vegetables: Handling, processing, fermentation and waste management*. Indus Publishing Company.
3. Yahia, E. (Ed.). (n.d.). *Postharvest biology and technology of tropical and subtropical fruits: Volume 1: Fundamental issues* (Woodhead Publishing Series in Food Science, Technology and Nutrition No. 206). Universidad Autónoma de Querétaro, Mexico: Woodhead Publishing.
4. Sethi, V., Dekka, B. C., Sethi, V., & Sethi, S. (n.d.). *Processing of fruits and vegetables for value addition*. Indus Publishing.
5. Thompson. (n.d.). *Post-harvest technology of fruits and vegetables*. CBS Publishers and Distributors.
6. Hui, Y. H. (Ed.). (n.d.). *Handbook of fruits and fruit processing*. John Wiley & Sons.
7. Rodrigues, S., & Fernandes, F. A. N. (n.d.). *Advances in fruit processing technologies*. CRC Press.
8. Food and Agriculture Organization. (n.d.). *Quality control in fruit and vegetable processing* (Issue 39). Food and Agriculture Organization of the United Nations.
9. Fellows, P., & Hampton, A. (n.d.). *Small-scale food processing: A guide to appropriate equipment*. Intermediate Technology Publications.
10. Indian Council of Agricultural Research (ICAR). (n.d.). *Handbook of horticulture*. ICAR.
11. Randhawa, G. S., & Mukhopadhyay, A. (n.d.). *Floriculture in India*. Allied Publishers.

**Choice Based Credit System Syllabus (2024 Pattern)
Mapping of Program Outcomes with Course Outcomes**

Class : S.Y. B. Sc. (Sem. IV)

Subject : Botany

Course: Industrial Botany

Course Code : BOT-256-MN

Weightage: 1= Weak or low relation, 2= Moderate or Partial relation, 3= Strong or direct relation

	Programme Outcomes (POs)												
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO9	PO10	PO11	PO12	PO13
CO 1		3	3							3	3	3	3
CO 2		3				3		2					
CO 3						2							
CO 4	3			3					2				
CO 5	3				3				1				
CO 6	3								2				
CO 7							2						

Justification for the mapping

PO1: Comprehensive Knowledge and Understanding

CO4. Develop plant tissue culture industry.

CO5. Get expertise to develop agro based industries.

CO6. Get expertise in field of Industrial Botany.

PO2: Practical, Professional, and Procedural Knowledge

CO1. Prepare different garden at personal level and to encourage people.

CO2. Expert in hydroponic techniques.

PO3: Entrepreneurial Mindset and Knowledge

CO1. Prepare different garden at personal level and to encourage people.

PO4: Specialized Skills and Competencies

CO5. Get expertise to develop agro based industries.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning

CO5. Get expertise to develop agro based industries.

PO6: Communication Skills and Collaboration

CO2. Expert in hydroponic techniques.

PO7: Research-related Skills

CO7. Understand basics of plant resource based industries.

PO8: Learning How to Learn Skills

CO2. Expert in hydroponic techniques.

PO9: Digital and Technological Skills

CO4. Develop plant tissue culture industry.

CO5. Get expertise to develop agro based industries.

CO6. Get expertise in field of Industrial Botany.

PO10: Multicultural Competence, Inclusive Spirit and Empathy

CO1. Prepare different garden at personal level and to encourage people. CO2. Expert in hydroponic techniques.

PO11: Value Inculcation and Environmental Awareness

CO3. Start the own business in cold storage, packing of flowers and fruits.

PO12: Autonomy, Responsibility and Accountability

CO3. Start the own business in cold storage, packing of flowers and fruits.

PO13: Community Engagement and Service

CO3. Start the own business in cold storage, packing of flowers and fruits.

Name of the Programme	:	B. Sc. Botany
Programme Code	:	USBT
Class	:	S. Y. B. Sc.
Semester	:	IV
Course Type	:	Minor (Practical)
Course Code	:	BOT-257-MN
Course Title	:	Practical Based on Industrial Botany
No. of Credits	:	02
No. of Teaching Hours	:	60

A) Learning Objectives:

1. Understand Hydroponic Systems and Media
2. Familiarization with Nursery Tools and Gardening Techniques.
3. Develop Skills in Kokedama and Bonsai Preparation.
4. Learn the Principles of Fruit Processing.
5. Practical Experience in Making Jam, Jelly, Squash, and Pickles.
6. Techniques of Ketchup Preparation.
7. Extraction and use of Scented Oils

B) Learning Outcomes:

By the end of the course, students will be able to:

- CO1. Understand the types of hydroponic media, their properties, and their role.
CO2. Explore various hydroponic systems and nutrient solutions.
CO3. Learn about different nursery tools.
CO4. Gain hands-on experience in plant artistry, Kokedama and Bonsai techniques.
CO5. Learn the principles of fruit processing and preservation methods.
CO6. Acquire skills in making jam, squash and pickles.
CO7. Explore methods of extracting scented oils.

Practical based on Industrial Botany

1. Hydroponic technology.
2. Media Required for Hydroponics
3. Bottle garden.
4. Preparation of Kokedama.
5. Bonsai Technique.
6. Study of Post-Harvest Equipment and Tools
7. Preparation of Jam.
8. Preparation of Squash.
9. Preparation of Pickles.
10. Preparation of Ketchup.
11. Preparation of herbal astringent lotion.
12. Preparation of Herbal face pack.
13. Preparation of Herbal hair mask.
14. Visit to Nursery / Food / Herbal cosmetic Industry (Submission of visit report is compulsory in semester end examination).

Choice Based Credit System Syllabus (2024 Pattern)
Mapping of Program Outcomes with Course Outcomes

Class : S.Y. B. Sc. (Sem. IV)

Subject : Botany

Course: Industrial Botany

Course Code : BOT-256-MN

Weightage: 1= Weak or low relation, 2= Moderate or Partial relation, 3= Strong or direct relation

	Programme Outcomes (POs)												
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO 1	3				2			3		3	3	3	3
CO 2		3		3				3	2	2			
CO 3						3			2		2		
CO 4		2	2			3	2		3			2	
CO 5			1						3				2
CO 6	3								3				
CO 7	3			3	2				3				

Justification of Mapping:

PO1: Comprehensive Knowledge and Understanding

CO1. Understand the types of hydroponic media, their properties, and their role.

CO6. Acquire skills in making jam, squash and pickles.

CO7. Explore methods of extracting scented oils.

PO2: Practical, Professional, and Procedural Knowledge

CO2. Explore various hydroponic systems and nutrient solutions

CO4. Gain hands-on experience in plant artistry, Kokedama and Bonsai techniques.

PO3: Entrepreneurial Mindset and Knowledge

CO4. Gain hands-on experience in plant artistry, Kokedama and Bonsai techniques.

CO5. Learn the principles of fruit processing and preservation methods.

PO4: Specialized Skills and Competencies

CO2. Explore various hydroponic systems and nutrient solutions.

CO7. Explore methods of extracting scented oils

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning

CO1. Understand the types of hydroponic media, their properties, and their role

CO7. Explore methods of extracting scented oils.

PO6: Communication Skills and Collaboration

CO3. Learn about different nursery tools.

CO4. Gain hands-on experience in plant artistry, Kokedama and Bonsai techniques.

PO7: Research-related Skills

CO4. Gain hands-on experience in plant artistry, Kokedama and Bonsai techniques.

PO9: Digital and Technological Skills

CO1. Understand the types of hydroponic media, their properties, and their role.

CO2. Explore various hydroponic systems and nutrient solutions.

PO10: Multicultural Competence, Inclusive Spirit and Empathy

CO1. Understand the types of hydroponic media, their properties, and their role.

CO2. Explore various hydroponic systems and nutrient solutions.

PO11: Value Inculcation and Environmental Awareness

CO1. Understand the types of hydroponic media, their properties, and their role.

CO2. Explore various hydroponic systems and nutrient solutions.

PO12: Autonomy, Responsibility and Accountability

CO1. Understand the types of hydroponic media, their properties, and their role.

CO2. Explore various hydroponic systems and nutrient solutions.

PO13: Community Engagement and Service

CO1. Understand the types of hydroponic media, their properties, and their role.

Name of the Programme	:	B.Sc. Botany
Program Code	:	USBT
Semester	:	IV
Course Type	:	OE (Practical)
Course Code	:	BOT-258-OE
Course Title	:	Horticulture
No. of Credits	:	02
No. of Teaching Hour	:	60

A) Course Objectives:

1. To introduction to Horticultural Tools and Techniques.
2. To understanding Horticultural Crops
3. To prepare seed bed and nursery bed.
4. To understand propagation methods.
5. To develop students 'skills in the training and pruning of fruit plants.
6. To instruct students on the preparation of potting mixtures and the application of fertilizers
7. To provide students practical exposure to horticulture industry.

B) Course Outcomes:

By the end of the course, students will be able to:

CO1. Demonstrate Proficiency in Using Garden Tools.

CO2. Understand and Classify Horticultural Crops.

CO3. Prepare seed beds and nursery beds.

CO4. Capable of implementing sexual propagation methods in plants.

CO5. Able to apply layering techniques for propagation of plants.

CO6. Develop the skills in grafting techniques.

CO7. Able to observe and evaluate the practices used in commercial nurseries and orchards

Practicals

1. Study of Garden Tools.	1P
2. Study of Horticultural crops.	1P
3. Preparation of seed bed/nursery bed.	1P
4. Study of sexual methods of propagation.	1P
5. Studies on propagation by Cuttings.	1P
6. Studies on propagation by Layering.	1P
7. Studies on propagation by Grafting.	1P
8. Studies on propagation by Budding.	1P
9. Propagation through specialized Vegetative structures.	1P
10. Layout and planting of orchard.	1P
11. Training and Pruning of fruit plants.	2P
12. Preparation of potting mixture.	1P
13. Fertilizer application in different crops.	1P
14. Visit to commercial nurseries/orchard.	1P

Choice Based Credit System Syllabus (2024 Pattern)
Mapping of Program Outcomes with Course Outcomes

Class : S.Y. B. Sc. (Sem. IV)

Subject : Botany

Course: Horticulture Practical

Course Code : BOT-258-OE

Weightage: 1= Weak or low relation, 2= Moderate or Partial relation, 3= Strong or direct relation

Course Outcomes	Programme Outcomes (POs)												
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	2	3	2	3			1			3	2		3
CO2	3							3	2				
CO3		3	2										
CO4				3	3			2					2
CO5	2				3					2	2		
CO6		3		3				2					

Justification for the mapping

PO.1 Comprehensive Knowledge and Understanding:

CO1. Demonstrate Proficiency in Using Garden Tools.

CO3. Prepare seed beds and nursery beds.

CO5. Able to apply layering techniques for propagation of plants.

PO2. Practical, Professional and Procedural Knowledge:

CO1. Demonstrate Proficiency in Using Garden Tools.

CO3. Prepare seed beds and nursery beds.

CO6. Develop the skills in grafting techniques.

CO7. Able to observe and evaluate the practices used in commercial nurseries and orchards.

PO3. Entrepreneurial Mind-set and Knowledge:

CO1. Demonstrate Proficiency in Using Garden Tools.

CO3. Prepare seed beds and nursery beds.

CO7. Able to observe and evaluate the practices used in commercial nurseries and orchards.

PO4. Specialized Skills and Competencies:

CO1. Demonstrate Proficiency in Using Garden Tools.

CO4. Capable to implement sexual propagation methods in plants.

CO6. Develop the skills in grafting techniques.

CO7. Able to observe and evaluate the practices used in commercial nurseries and orchards.

PO5. Capacity for Application, Problem-Solving, and Analytical Reasoning

CO4. Capable to implement sexual propagation methods in plants.

CO5. Able to apply layering techniques for propagation of plants.

CO7. Able to observe and evaluate the practices used in commercial nurseries and orchards.

PO6. Communication Skills and Collaboration

CO7. Able to observe and evaluate the practices used in commercial nurseries and orchards.

O7. Research-related Skills.

CO1. Demonstrate proficiency in using garden tools.

CO7. Able to observe and evaluate the practices used in commercial nurseries and orchards.

PO8. Learning How to Learn Skills

CO2. Understand and classify horticultural crops.

CO4. Capable to implement sexual propagation methods in plants.

CO6. Develop the skills in grafting techniques.

PO9. Digital and Technological Skills

CO2. Understand and classify horticultural crops.

CO7. Able to observe and evaluate the practices used in commercial nurseries and orchards.

PO10. Multicultural Competence, Inclusive Spirit, and Empathy

CO1. Demonstrate proficiency in using garden tools.

CO5. Able to apply layering techniques for propagation of plants.

PO11. Value Inculcation and Environmental Awareness

CO1. Demonstrate proficiency in using garden tools.

CO5. Able to apply layering techniques for propagation of plants.

CO7. Able to observe and evaluate the practices used in commercial nurseries and orchards.

PO12. Autonomy, Responsibility, and Accountability

CO7. Able to observe and evaluate the practices used in commercial nurseries and orchards.

PO13. Community Engagement and Service

CO1. Demonstrate proficiency in using garden tools.

CO4. Capable to implement sexual propagation methods in plants.

CO7. Able to observe and evaluate the practices used in commercial nurseries and orchards.

Name of the Programme	:	B. Sc. Botany
Program Code	:	USBT
Class	:	S. Y. B. Sc.
Semester	:	IV
Course Type	:	SEC (Practical)
Course Code	:	BOT-259-SEC
Course Title	:	Practical based on Floriculture
No. of Credits	:	02
No. of Teaching Hours	:	60

A) Course Objectives:

1. To inculcate the importance of studying floriculture and usage of floricultural crops.
2. To equip the students with practical knowledge of different horticultural practices of floricultural crops.
3. To familiarize the students with the floriculture based industries at national and international level.
4. To familiarize the students with the flowers and foliage crop used in flower arrangement.
5. To give knowledge of different types of flower arrangement.
6. To give knowledge of care and precautions taken during flower arrangement.
7. To impart the basic skills in the field of floriculture.

B) Course Outcomes:

By the end of the course, students will be able to:

- CO1. Understand plants used in floriculture.
- CO2. Knowledge of horticultural practices of floricultural crops.
- CO3. Knowledge of floriculture based industries.
- CO4. Knowledge of flowers and foliage crop used in flower arrangement.
- CO5. Create different floral designs.
- CO6. Take care and precautions during flower arrangement.
- CO7. Develop entrepreneurship in floriculture.

Practicals

1. Study of natural plant propagation methods (Rhizome, Bulb, Sucker, Runners).
2. Study of artificial plant propagation methods. Cutting and Grafting.
3. Study of artificial plant propagation methods. Air layering and Budding.
4. Study of cut flowers in flower arrangement.
5. Study of loose flower in flower arrangement.
6. Study of different methods of storage of flowering crops.
7. Study of different methods of packaging of flowering crops.
8. Study of different materials used in flower arrangement (Floral foams, Vase, Floral pin etc.).
9. Preparation of flower arrangement, Western type: Round, Symmetrical and Asymmetrical.
10. Preparation of flower arrangement, Western type: Hogarth, Cascade and Vertical.
11. Preparation of flower arrangement (Eastern type: Ikebana).
12. Preparation of garlands, bouquets and button holes.
13. Preparation of floral wheel, flower basket, floral rangoli and floral ornaments.
14. Study of techniques of drying flower crops.
15. Study of techniques of preparation of dry flower arrangement.

Choice Based Credit System Syllabus (2024 Pattern)
Mapping of Program Outcomes with Course Outcomes

Class : S.Y. B. Sc. (Sem. IV)

Subject : Botany

Course: SEC (Practical)

Course Code : BOT-259-SEC

Weightage: 1= Weak or low relation, 2= Moderate or Partial relation, 3= Strong or direct relation

	Programme Outcomes (POs)												
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO9	PO10	PO11	PO12	PO13
CO 1	3												
CO 2	3			3						3			3
CO 3	3		3							2			3
CO 4	3												2
CO 5		2					2	3	3		3		2
CO 6					3		3	3			2		2
CO 7			2			2						3	

Justification for the mapping

PO1. Comprehensive Knowledge and Understanding

CO1. Understand plants used in floriculture.

CO2. Knowledge of horticultural practices of floricultural crops.

CO3. Knowledge of floriculture based industries.

CO4. Knowledge flowers and foliage crop used in flower arrangement.

PO2. Practical, Professional, and Procedural Knowledge

CO5. Create different floral designs.

PO3. Entrepreneurial Mindset and Knowledge

CO3. Knowledge of floriculture based industries.

CO7. Develop entrepreneurship in floriculture.

PO4. Specialized Skills and Competencies

CO2. Knowledge of horticultural practices of floricultural crops.

PO5. Capacity for Application, Problem-Solving, and Analytical Reasoning

CO6. Take care and precautions during flower arrangement.

PO6. Communication Skills and Collaboration

CO7. Develop entrepreneurship in floriculture.

PO7. Research-related Skills

CO5. Create different floral designs.

CO6. Take care and precautions during flower arrangement.

PO8. Learning How to Learn Skills

CO6. Take care and precautions during flower arrangement.

PO9. Digital and Technological Skills

CO5. Create different floral designs.

PO10 Multicultural Competence, Inclusive Spirit, and Empathy

CO2. Knowledge of horticultural practices of floricultural crops.

CO3. Knowledge of floriculture based industries.

PO11. Value Inculcation and Environmental Awareness

CO5. Create different floral designs.

CO6. Take care and precautions during flower arrangement.

PO12 Autonomy, Responsibility, and Accountability

CO7. Develop entrepreneurship in floriculture.

PO13. Community Engagement and Service

CO2. Knowledge of horticultural practices of floricultural crops.

CO3. Knowledge of floriculture based industries.

CO4. Knowledge of flowers and foliage crop used in flower arrangement.

CO5. Create different floral designs.

CO6. Take care and precautions during flower arrangement.