



# **Savitribai Phule Pune University, Pune**

**(Formerly, University of Pune)**

**Under Graduate Degree Program in Botany (B.Sc. Botany)**

**(Faculty of Science & Technology)**

**Revised Syllabi as per National Education Policy (2020) for**

**F.Y.B.Sc. Botany (Semester-I and II)**

**(For Colleges Affiliated to Savitribai Phule Pune University, Pune)**

**To be implemented from**


**Academic Year 2024-2025**

**Framed by**

**BOARD OF STUDIES IN BOTANY**

**Savitribai Phule Pune University,**

**Ganeshkhind, Pune -07.**

  
(Dr. Mahesh N. Khavde)  
Chairman - Bos Botany

**AIMS AND OBJECTIVES**

- To develop employability oriented diversified course content.
- To introduce skill oriented specialized education by introducing in-depth learning concepts.
- To expose students to the process of systematic academic inquiry and exhibiting courtesy to the vast universe of basic and applied knowledge of plants.

**PROGRAM OUTCOMES (POS)**

According to NEP-2020 criteria, the Under Graduate degree in Botany (F.Y.B.Sc. Botany) program at Savitribai Phule Pune University, Pune's associated colleges, is structured to provide students with advanced field-related knowledge and essential fundamentals. Through a unique combination of required major core courses with in-depth exposure to multidisciplinary minor, elective, and vocational skill courses, among other courses, students will be trained and acquire the fundamental and advanced knowledge essential to the plant sciences industries.

With the knowledge gained in the field of plant sciences, this upgraded curriculum will develop educated, outcome-oriented candidates who are nurtured through discovery and learning, equipped with practice and skills to deal with practical problems, and competent with recent pedagogical trends in education, including E-learning, flipped class, hybrid learning, and experiential learning. These candidates will become responsible citizens, transforming the nation to lead the world in the future.

After successful completion of the Under Graduate (UG) Degree program, the students would be able to:

**PO1:** Attain thoughtful proficiency in the field of plant sciences.

**PO2:** Acquire the ability to perform in multidisciplinary domains.

**PO3:** Attain the ability to exercise intelligence of scientific knowledge for investigation and innovation and nourishment of the world.

**PO4:** Learn value based ethical practices and principles committed to professional ethics.

**PO5:** Incorporate 21<sup>st</sup> century skill oriented self-directed and life-long learning.

**PO6:** Obtain ability to inculcate the knowledge of plant science in diverse contexts with global perspective.

**PO7:** Attain maturity to harness the destiny and responds to one's calling.

**PROGRAM SPECIFIC OUTCOMES (PSOs)**

**PSO1:** Recall the diversity, classification, evolution and developmental changes among the plants with reference to lower and higher plant groups and create a knowledge base

in understanding the basis of plant diversity, economic values and taxonomy of plants.

**PSO2:** Understand the advanced concepts of Genetics, Cell biology and Plant Biotechnology of plants and its implementation for the improvement of crop productivity.

**PSO3:** Acquire and utilize the skills of post-harvest, flower design, fruit processing and dehydration techniques, organic farming and various plant processing technologies for developing the economy to the growing world.

**PSO4:** Know about the importance of Medicinal plants and its useful parts, economically important plants in our daily life and also about the traditional medicines and herbs, and its relevance in modern times.

**PSO5:** Inculcate the methodology followed in plant breeding, pharmacognosy, herbal drug technology, plant protection, propagation and improvement.

**PSO6:** Adapt methods of scientific research in plant improvement program and create entrepreneurships, employment to the society.

**PSO7:** Analyze the impact of scientific and technological advances on the environment and society and understand the importance of biodiversity conservation, green cover development, carbon sequestration and utilize the knowledge for sustainable development.

**PSO8:** Explore the knowledge of biotic and abiotic stress tolerance, plant microbe interaction and Integrate pest management for making the revolution in the agriculture.

**PSO9:** Enrich the ability of critical thinking, development of scientific attitude, handling of problems and generating solutions, improve practical skills, and enhance communication skill.

**PSO10:** Apply the fruitful knowledge of plant sciences and plant resources for the sustainable development, betterment of society and environment by recognizing the ethical values.

**PSO11:** Become competent enough in various analytical and 21st century technical skills related to plant sciences for their exploration.

**PSO12:** Exhibit the potential to effectively accomplish tasks independently and as a member or leader in diverse teams, and in multidisciplinary settings.

**PSO13:** Employ critical thinking based problem solving and practical skills pertaining to botanical techniques and computational knowledge and apply strategies for environmental conservation.

**PSO14:** Demonstrate knowledge and scientific understanding to identify research problems, design experiments, use appropriate methodologies, analyze and interpret

data and provide solutions. Exhibit organizational skills and the ability to manage time and resources.

**1. Title of the Course: B.Sc. Botany (03 years) / B.Sc. with Honours in Botany (04 years)**

Syllabus revised as per National Education Policy (NEP) 2020 for the Colleges Affiliated to Savitribai Phule Pune University, Pune

**2. Faculty - Science and Technology**

**3. To be implemented** -For F.Y.B.Sc. (Semester I and Semester II), from August 2024.

**4. Preamble -**

Plants are the sole true foundation for all scientific disciplines since they create all kinds of ecosystems and are necessary for all other life forms on Earth to survive. Through both basic and applied research, the study of botany has a significant potential to assist the nation in achieving its sustainable goals. The world's overpopulation is having a concerning effect on the development and productivity of food (particularly plants), in addition to the ever-increasing challenges of environmental contamination brought on by unfavourable climatic changes, global warming, and natural disasters.

Botany is the only supreme foundation of all sciences, because plants, as producers of all kinds of ecosystems, play a critical role in the survival and existence of all other living things on the planet. Botany has tremendous potential for achieving the nation's long-term goals by utilizing it at both the basic and applied levels. In the current scenario, the world's overpopulation, combined with the day-by-day increasing problems of environmental pollution caused by adverse climatic changes, global warming, and natural calamities, is severely affecting the growth, development, and productivity of produce (particularly plants) to alarming levels.

Higher education in plant sciences should be encouraged for students with backgrounds in the life sciences, with an emphasis on applying the most recent data, expertise, and abilities from both basic and applied branches to develop solutions for sustainable development. In light of this curriculum has been designed to equip students with the knowledge and skills they will need to handle problems pertaining to the needs and worries of both the environment and the human population. In order to accomplish these goals, every effort is made to guarantee high standards of education by implementing numerous strategies to enhance the teaching-learning process, assessment and evaluation methods, and making sure that students are developed holistically in line with the goals and standards of NEP 2020.

The thoughtfully crafted F.Y.B.Sc. Botany curriculum combines a focus on subjects linked to advanced agriculture, the plant-based industry, and pharmaceutical companies with a deep comprehension of the subject's fundamental concepts. This will inspire and attract life science students to seek M.Sc. and Ph.D. degrees in botany in order to become prosperous entrepreneurs, proficient workers, or sophisticated farmers who can address social and environmental issues as a part of sustainable development.

The National Education Policy (NEP-2020), which is being implemented by the Ministry of Higher Education, the Government of India, and the University Grants Commission (UGC), offers opportunities for developing 21<sup>st</sup> century advanced skills based on the Indian knowledge system through research internships with renowned and esteemed faculty and researchers at their own or other HEIs / research institutes. Additionally, it acknowledges, pinpoints, and nurtures each student's distinct talents in order to support their overall growth and strengthen the country. This will empower Indian youngsters in the field of plant sciences globally and assist the country establish a solid foundation on the global market. Our nation boasts the highest percentage of young people, who, after receiving a top-notch education, have the potential to govern the world in the years to come.

In order to address problems pertaining to plant sciences, such as biodiversity conservation, soil health, plant nutrition, plant wealth and plant-based resource management, interactions between plants and microorganisms, plant pathogens and diseases, and carbon sequestration, the B.Sc. Botany curriculum offers a thorough theoretical and practical knowledge base. In the exploration of plant sciences, students will be able to stand independently and with confidence.

### **Program Duration and Exit Options**

The UG Program lasts for four years or eight semesters.

Student may leave the program after the third year if, he/she would like to receive a three-year undergraduate degree.

If the student decides to withdraw after the first or second year, he/she will receive a UG Certificate or UG Diploma, depending on how many credits he/she is able to complete. Re-entering within three years to finish the degree program is allowed for students who leave with a UG certificate or UG diploma. A student must earn a minimum of 18 credits and a maximum of 26 credits each semester. It is recommended, nevertheless, that student should opt 22 credits per semester. This clause aims to give student the comfort of a flexible semester-based course load. However, Table 1 lists the minimum number of credits

required to be earned in order to be awarded an Undergraduate Certificate/Undergraduate Diploma/Bachelor Degree/Bachelor's Degree with Honors in Botany.

**Table1: Type of Awards and Stages of Exit**

Sr. No.	Type of Award	Stage of Exit	Mandatory Credits
1.	Undergraduate Certificate in Botany	After successful completion of First year Semesters	44
2.	Undergraduate Diploma in Botany	After successful completion of Second year Semesters	88
3.	Bachelor of Science in Botany	After successful completion of Third year Semesters	132
4.	Bachelor of Science in Botany (Honours)	After successful completion of Fourth year Semesters	176

### 5. Eligibility Criteria -

The basic criteria for Under Graduate Degree (F.Y.B.Sc. Botany) admission will be 10+2 criteria with Biology, Physics, Chemistry, Mathematics, and Geography as Principal subjects OR MCVC OR Diploma courses related to Plant Sciences. Admissions will be given as per the selection procedure / policies adopted by the college keeping in accordance with the conditions laid down by the Savitribai Phule Pune University, Pune. Reservation and relaxation are as per the State Government rules.

**6. Fee Structure** – As per the norms of Savitribai Phule Pune University, Pune.

### 7. Duration of the Course

Certificate Course- 01 year (Completion of 02 Semesters)

Diploma Course- 02 years (Completion of 04 Semesters)

BSc Degree- 03 years (Completion of 06 Semesters)

BSc Degree with Honours- 04 years (Completion of 08 Semesters)

**8. No. of semesters** – Two semesters per year

**9. Medium of instructions and teaching:** English

### 10. Course Implementation criteria for Theory and Practical:

**a.** Each semester comprises of 15 weeks (12 weeks Actual Teaching + 3 weeks for Continuous Internal Evaluation).

**b. One Credit of the Theory** is equal to 15 clock hours (Teaching 1 hour per week for each credit, 12 hours Actual Teaching + 3 hours Continuous Internal Evaluation – Assignments, Tutorials, Practice, Problem solving sessions, Group discussion, Seminars and Unit Tests.

**c. One Credit of Practical** = 30 clock hours. (2 Contact hours per credit per week)

One Credit = 30 clock hours (24 hours' Actual Table work + 6 hours for journal competition, and Continuous Internal Evaluation of each practical).

**d. Practical for each course comprises of 02 Credits = 60 clock hours.** Therefore,

- Minimum 12 laboratory sessions of 04 clock hours must be conducted in one semester.
- In case of short practical, two practicals should be conducted in one session.
- Each practical of 04 clock hours in the laboratory should consist of: Table performance for concerned practical, careful observations, calculation, writing results and conclusion, and submission of practical in written form.
- Pre-laboratory reading and post laboratory assignments should be given on each practical as a part of continuous internal evaluation.

**11. Examination Pattern (For each Semester):** The examinations will be conducted semester wise for both Theory as well as Practical courses.

- **Theory Paper of 02 Credits -**
  - Internal Exam (15 M) + University Theory Exam (35 M) = Total 50 M
  - Duration: For Internal exam = 40 Min. and For University Exam = 02 hours.
- **Practical Paper of 2 Credits -**
  - Internal Exam (15 M) + University Practical Exam (35 M) = Total 50 M
  - Duration: For Internal exam = 40 Min. and For University Exam = More than 04 hours.

**12. Award of Class/Grade:** The class / grade for the courses of each semester will be followed as per the norms and conditions laid down by SPPU, Pune.

**13. ATKT Rules:** As per the norms given by SPPU, Pune.

**14. Important Note:**

a. There shall be at least a short tour/field visit/industrial visit (1-2 days) per year for all UG students. Tours are the part of curriculum and obligatory to each student, failing which they will not be considered eligible to appear for the practical examination. Under unavoidable circumstances, if the student fails to attend the tour, he/she have to produce justifiable evidence for not attending the tour. However, in lieu of tour the candidate will have to complete the work assigned by the Department.

c. The documents to be produced by each student at the time of practical examination (at the end of each Semester) are:

- Submission of practical records (Journals).
- Submission of a Tour / Visit report duly signed by the concerned practical In-charge and Head of the Department.
- Any submissions / assignments, etc. based on the practical course.

### Question paper pattern for Theory (2 Credit courses)

A student will have to solve the question paper of 35 marks. The paper setter should set the paper on entire syllabus for total 61 marks, including optional questions. As the course is of 2 Credits (30 clock hour lectures), paper setter should allot 2.03 marks per lecture and accordingly, questions should be set for 30 lectures, 61 marks on entire syllabus.

**Note: All questions are compulsory.**

**Time: 2 Hours**

- |   |          |
|---|----------|
| Que. 1) Answer any five of the following in one sentence  | 05 Marks |
| <ul style="list-style-type: none"><li>• Six questions</li><li>• Each for 1 mark</li></ul>                 |          |
| Que. 2a) Write any one of the following   | 06 Marks |
| <ul style="list-style-type: none"><li>i.</li><li>ii.</li></ul>  |          |
| Que. 2b) Write any one of the following   | 04 Marks |
| <ul style="list-style-type: none"><li>i.</li><li>ii.</li></ul>  |          |
| Que. 3a) Solve any one of the following   | 06 Marks |
| <ul style="list-style-type: none"><li>i.</li><li>ii.</li></ul>  |          |
| Que. 3b) Solve any one of the following   | 04 Marks |
| <ul style="list-style-type: none"><li>i.</li><li>ii.</li></ul>  |          |
| Que. 4) Write notes on (Any four)   | 10 Marks |
| <ul style="list-style-type: none"><li>a.</li><li>b.</li><li>c.</li><li>d.</li><li>e.</li><li>f.</li></ul> |          |



## CREDIT FRAMEWORK FOR F.Y.B.Sc. BOTANY, SEMESTER – I and II (Level 4.5 / 100)

SEMESTER I			
COURSE DETAILS	COURSE CODE	COURSE TITLE	CREDITS
<b>Subject 1 –</b> <b>(1T + 1P) x 2 C = 4 C</b>	BOT-101-T	Applied Aspects of Plant Sciences	2 C
	BOT-102-P	Practical Based on BOT-101-T	2 C
<b>Subject 2 –</b> <b>(1T + 1P) x 2 C = 4 C</b>	Subject 2 -T	-----	2 C
	Subject 2 -P	-----	2 C
<b>Subject 3 –</b> <b>(1T + 1P) x 2 C = 4 C</b>	Subject 3 -T	-----	2 C
	Subject 3 -P	-----	2 C
<b>Generic Elective (GE) /</b> <b>Open Elective (OE) -</b> <b>(1T = 2 C)</b> <b>(Any one from basket)</b>	OE-101-BOT-T	Agro-tourism	2 C
	OE-102-BOT-T	Plants and Human Welfare	
	OE-103-BOT-T	Agriculture for Competitive Exams	
<b>Skill Enhancement</b> <b>Courses (SEC) –</b> <b>(1T / 1P = 2 C)</b> <b>(Any one from basket)</b>	SEC-101-BOT-P	Flower Design Techniques	2 C
	SEC-102-BOT-P	Post-Harvest Technology	
	SEC-103-BOT-P	Algal Technology	
<b>Indian Knowledge Systems</b> <b>(IKS) – (1T = 2 C)</b>	IKS-101-T	Generic	2 C
<b>Ability Enhancement</b> <b>Course (AEC) – (1T = 2 C)</b>	AEC-101-ENG-T	English	2 C
<b>Value Education Courses</b> <b>(VEC) – (1T = 2 C)</b>	VEC-101-ENV-T	Environmental Awareness	2 C
<b>Total Credits (V1+V2+V3+V4+V5+V6)</b>			<b>22 C</b>
SEMESTER – II			
<b>Subject 1 –</b> <b>(1T + 1P) x 2 C = 4 C</b>	BOT-151-T	Basics of Plant Sciences	2 C
	BOT-152-P	Practical Based on BOT-151-T	2 C
<b>Subject 2 –</b> <b>(1T + 1P) x 2 C = 4 C</b>	Subject 2 -T	-----	2 C
	Subject 2 -P	-----	2 C
<b>Subject 3 –</b> <b>(1T + 1P) x 2 C = 4 C</b>	Subject 3 -T	-----	2 C
	Subject 3 -P	-----	2 C
<b>Generic Elective (GE) /</b> <b>Open Elective (OE) -</b> <b>(1P = 2 C)</b> <b>(Any one from basket)</b>	OE-151-BOT-P	Fruit Processing and Flower Arrangement	2 C
	OE-152-BOT-P	Mushroom technology	
	OE-153-BOT-P	Vertical and Terrace Gardening	
<b>Skill Enhancement</b> <b>Courses (SEC) –</b> <b>(1T / 1P = 2 C)</b> <b>(Any one from basket)</b>	SEC-151-BOT-P	Plant Preservation Techniques	2 C
	SEC-152-BOT-P	Millets for Sustainable Agriculture Development	
	SEC-153-BOT-P	Plant Propagation Techniques	
<b>Ability Enhancement</b> <b>Courses (AEC) – (1T = 2 C)</b>	AEC-151-ENG-T	English	2 C
<b>Value Education Courses</b> <b>(VEC) – (1T = 2 C)</b>	VEC-151-ENV-T	Environmental Awareness	2 C
<b>Co-curricular Courses (CC)</b> <b>– (1T = 2 C)</b>	CC-151-T	Any one from basket	2 C
<b>Total Credits (V1+V2+V3+V4+V5+V6)</b>			<b>22 C</b>
<b>Total Credits for FYBSC - Semester I (22 C) + Semester II (22 C)</b>			<b>44 C</b>

**Exit Option:** Award of UG Certificate Course with 44 Credits and an additional 4 Credits core NSQF course / Internship OR Continue with Major and Minor.

**Continue option:** Student will select one subject among the subject 1, subject 2 and subject 3 as Major and another 2 as Minor and third subject will be dropped.

**F.Y. B. Sc. Botany  
Semester – I**

<b>COURSE DETAILS</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CREDITS</b>
<b>Subject 1 - (1T + 1P) x 2 C = 4 C</b>	BOT-101-T	Applied Aspects of Plant Sciences	<b>2 C</b>
	BOT-102-P	Practical Based on BOT-101-T	<b>2 C</b>
<b>Subject 2 - (1T + 1P) x 2 C = 4 C</b>	Subject 2 -T	-----	<b>2 C</b>
	Subject 2 -P	-----	<b>2 C</b>
<b>Subject 3 - (1T + 1P) x 2 C = 4 C</b>	Subject 3 -T	-----	<b>2 C</b>
	Subject 3 -P	-----	<b>2 C</b>

**F. Y. B. Sc. Botany [Semester - I]****Course Code - BOT-101-T****Course Title: Applied Aspects of Plant Sciences****[No. of Credits: 2 C]****[No. of Lectures: 30 L]****OBJECTIVES:**

1. Equip students with the practical skills needed to apply theoretical knowledge in plant sciences to real-world scenarios, such as agriculture, horticulture, and environmental management.
2. Familiarize students with modern techniques and technologies used in plant science research and applications, including genetic engineering, biotechnology, and molecular biology.
3. Educate students about sustainable practices in plant production and resource management, emphasizing the importance of environmental conservation and sustainable agriculture.
4. Enhance students' ability to analyse and solve complex problems in plant sciences, including issues related to crop productivity, pest management, and environmental sustainability.
5. Foster a culture of innovation and creativity among students, encouraging them to explore new ideas and approaches to address challenges in plant sciences and agriculture.

**OUTCOMES:**

1. Students will be able to apply advanced plant biotechnology techniques, such as genetic engineering and tissue culture, to improve crop productivity, develop genetically modified crops, and produce plant-derived pharmaceuticals.
2. Students will demonstrate the ability to implement and evaluate sustainable agricultural practices, including organic farming, integrated pest management, and the use of biofertilizers, to enhance soil health and crop yields while minimizing environmental impact.
3. Students will be proficient in utilizing precision agriculture technologies, such as remote sensing, GIS, drones, and sensors, to monitor and manage crop health, optimize resource use, and improve overall farm management efficiency.
4. Students will understand the role of plant-associated microbes in enhancing plant health and productivity, and be able to apply knowledge of beneficial microbes (e.g., *Rhizobium*, mycorrhizal fungi, PGPR) to improve soil fertility and plant growth in agricultural settings.

**F. Y. B. Sc. Botany [Semester - I]****Course Code - BOT-101-T****Course Title: Applied Aspects of Plant Sciences****[No. of Credits: 2 C]****[No. of Lectures: 30 L]**

Sr. No.	Topic Details	No. of Lectures
	<b>Credit I</b>	<b>15</b>
<b>1</b>	<b>Introduction to Applied Plant Sciences</b> 1.1. Overview of key concepts and principles 1.2. Importance of applied plant sciences in addressing global challenges.	<b>02</b>
<b>2</b>	<b>Plant Biotechnology</b> 2.1. Genetic engineering techniques in crop improvement. 2.2. Plant Tissue Culture for improvement of crop productivity. 2.3. Biopharmaceuticals and plant-derived drugs. 2.4. Applications of biotechnology in plant breeding and biotic/abiotic stress tolerance.	<b>04</b>
<b>3</b>	<b>Precision Agriculture</b> 3.1. Remote sensing and GIS applications in agriculture. 3.2. Use of drones and sensors for crop monitoring and management.	<b>03</b>
<b>4</b>	<b>Sustainable Agriculture Practices</b> 4.1. Organic farming methods and principles. 4.2. Integrated pest management strategies.	<b>03</b>
<b>5</b>	<b>Plant-Microbe Interactions</b> 5.1. Role of plant-associated microbes in plant health and productivity. 5.2. Applications of beneficial microbes in agriculture.	<b>03</b>
	<b>Credit II</b>	<b>15</b>
<b>6</b>	<b>Climate Change and Plant Sciences</b> 6.1. Impact of climate change on plant growth and agriculture. 6.2. Strategies for mitigating climate change effects through plant science interventions.	<b>03</b>
<b>7</b>	<b>Urban Agriculture and Vertical Farming</b> 7.1. Challenges and opportunities in urban agriculture. 7.2. Vertical farming technologies and their applications. 7.3. Ornamental plant cultivation. 7.4. Urban gardening and landscaping.	<b>03</b>
<b>8</b>	<b>Plant Health and Disease Management</b> 8.1. Diagnosis and management of plant diseases. 8.2. Emerging technologies for disease detection and control.	<b>03</b>
<b>9</b>	<b>Postharvest Technology</b> 4.1. Techniques for prolonging shelf life and maintaining quality of harvested produce. 4.2. Importance of postharvest management in reducing food loss and waste.	<b>03</b>
<b>10</b>	<b>Environmental applications</b> 10.1. Plant ecology and conservation 10.2. Ecological restoration techniques 10.3. Phytoremediation and air purification.	<b>03</b>

**References:**

1. "Principles of Applied Botany" by Mary E. Gressel
2. "Applied Plant Science: Principles and Practices" by Pamela M. Vance and Vance C. Ostolaza.
3. "Plant Pathology" by George N. Agrios.
4. "Soil Science: Principles and Practices" by R.K. Mehra.
5. "Principles of Plant Biotechnology" by P.K. Gupta.
6. "Principles of Weed Science" by S.S. Hundal.
7. "Introduction to Horticulture" by Kumar and Singh.
8. "Plant Physiology" by Pandey and Sinha.
9. "Principles of Plant Pathology" by S.N. Agarwal.
10. "Principles of Agronomy" by S.R. Reddy and G.H. Sankara Reddy.
11. "Plant Breeding: Principles, Methods and Applications" by B.D. Singh.
12. "Postharvest: An Introduction to the Physiology and Handling of Fruit, Vegetables and Ornamentals" by R. Wills, B. McGlasson, D. Graham, and D. Joyce
13. "Plant Nutrition and Soil Fertility Manual" by J. Benton Jones Jr.
14. "Sustainable Agriculture" edited by Eric Lichtfouse
15. "Crop Production: Evolution, History, and Technology" by C. Wayne Smith and Julian R. Smith.
16. "Plant Physiology and Development" by Lincoln Taiz, Eduardo Zeiger, Ian M. Møller, and Angus Murphy.
17. "Plant Biotechnology and Agriculture: Prospects for the 21st Century" edited by Arie Altman and Paul Michael Hasegawa.
18. "Principles of Plant Genetics and Breeding" by George Acquaaah.
19. "Remote Sensing Applications in Agriculture: Opportunities and Constraints" edited by B.S. Bhattacharya and S.K. Ghosh.
20. "Precision Agriculture: Technology and Economic Perspectives" edited by P. Sengupta and S. Shankar.
21. "Precision Farming in Horticulture: Approaches and Applications" edited by Debashis Mandal, V.K. Gupta, and R.N. Pal.
22. "Smart Technologies for Sustainable Smallholder Agriculture: Upscaling in Developing Countries" edited by Justice O. Alabi and Harjit Kaur.
23. "Precision Agriculture: Principles and Applications" edited by Manjit Singh and Rajan Bhatia.
24. "Climate Change and Agriculture: Adaptation Strategies and Mitigation Options" edited by Mannava V.K. Sivakumar, Raju Goyal, and Ashwani Kumar.
25. "Climate Change and Plant Biodiversity" edited by Dinesh Kumar and Anil K. Singh.
26. "Climate Change and Agricultural Ecosystems" edited by Mannava V.K. Sivakumar and James Hansen.
27. "Plant Responses to Climate Change: From Molecular to Ecosystems Perspective" edited by Chittaranjan Kole.
28. "Climate Change and Plant Abiotic Stress Tolerance" edited by Narendra Tuteja, Sarvajeet Singh Gill, Antonio F. Tiburcio, and Renu Tuteja.
29. "Urban Agriculture: Policy, Law, Strategy, and Implementation" by Mark Roseland and Wayne J. Caldwell.
30. "Vertical Farming: Concepts, Applications, and Challenges" edited by Kotikalapudi Sriram and Anuj Bhatia.
31. "Rooftop Urban Agriculture" by Francesco Orsini, Marielle Dubbeling, and Henk de Zeeuw.
32. "Urban Agriculture: A Global Perspective of the Role of Cities in Food Systems" edited by René van Veenhuizen.
33. "Vertical Farming: Sustainable Indoor Agricultural Systems" edited by Toyoki Kozai, Genhua Niu, and Michiko Takagaki.

**F. Y. B. Sc. Botany [Semester - I]****Course Code – BOT-102-P****Course Title: Practical Based on BOT-101-T****[No. of Credits: 2 C]****[No. of Lectures: 60 L]****OBJECTIVES:**

1. To equip students with hands-on experience in using essential laboratory instruments and equipment.
2. To provide students with a thorough understanding of the genetic engineering processes.
3. To train students soil health analysis and interpret the results in the context of soil health and sustainable agriculture.
4. To teach students the process of composting organic waste to produce biofertilizer and to evaluate its effectiveness in enhancing soil fertility and plant growth.
5. To demonstrate and practice post-harvest techniques.
6. To organize visits to nurseries and plant-based industries and train students for preparing visit reports to link theory with real-world applications.

**OUTCOMES:**

1. Students will develop hands-on expertise in using essential laboratory instruments and equipment.
2. Students will gain practical knowledge in demonstrating and evaluating genetically modified crops and evaluate the agronomic performance, environmental impact, and socio-economic benefits of these genetically modified crops.
3. Students will acquire the ability to estimate soil organic carbon using methods like Walkley-Black or similar wet oxidation techniques and interpret the significance of these measurements in soil health and sustainable agriculture.
4. Students will demonstrate the ability to compost kitchen waste and convert it into biofertilizer, highlighting the principles of organic waste management and sustainable recycling.
5. Students will study the effect of Mycorrhiza on crop plant growth attributes and understand the role of various plant-associated microbes, such as Rhizobia, Mycorrhizal fungi, PGPR, endophytic fungi, and nitrogen-fixing cyanobacteria, in improving plant health and productivity.
6. Students will demonstrate post-harvest techniques, including the preparation, value addition and preservation of agricultural products.
7. Students will visit nurseries and plant-based industries to explore exotic ornamental plants and industry products and by-products, preparing visit reports to understand their applications in indoor gardening and economic importance.

**F. Y. B. Sc. Botany [Semester - I]****Course Code – BOT-102-P****Course Title: Practical Based on BOT-101-T****[No. of Credits: 2 C]****[No. of Lectures: 60 L]**

Sr. No.	Title of the Practical	No. of Practical
1	Study of principles, working and practical applications of instruments and equipment used in plant tissue culture - pH meter, Autoclave, Hot air oven, Laminar Air Flow, Micropipettes, Digital One Pan Balance, Glass Distillation Unit).	1 P
2	Demonstration of genetically modified crops – Bt –Cotton, Bt-Maize, Golden Rice, Round-up ready Soybean.	1 P
3	Estimation of soil organic carbon by using Walkley-Black or Similar method (Wet oxidation).	1 P
4	To study the degradation of toxic textile dyes using plant biomass and its characterization using UV-Spectrophotometer and/or FTIR.	1 P
5	Study of petiole analysis of stressed and unstressed plants.	1 P
6	To demonstrate the composting of kitchen waste for the preparation of biofertilizer.	1 P
7	Demonstration of <i>Azolla</i> cultivation, nutrition and production attributes and its application as biofertilizer.	1 P
8	Preparation of 'Sanjivani Amrut' and its application to the crop and garden plants.	1 P
9	To study the effect of Mycorrhiza on growth attributes of crop plants.	1 P
10	Study on preparation of Dashparni Ark and EM solution.	1 P
11	Study of various plant-associated microbes useful in improvement of plant health and productivity – Rhizobia – <i>Rhizobium</i> ; Mycorrhizal Fungi - arbuscular mycorrhizal fungi (AMF) such as <i>Glomus</i> spp., and ectomycorrhizal fungi (ECM) like <i>Laccaria</i> spp. and <i>Pisolithus</i> spp.; Plant Growth-Promoting Rhizobacteria (PGPR) - <i>Pseudomonas</i> , <i>Bacillus</i> , and <i>Azospirillum</i> spp.; Endophytic fungi - <i>Trichoderma</i> and <i>Claviceps</i> spp.; Nitrogen-Fixing Cyanobacteria: <i>Nostoc</i> .	1 P
12	To demonstrate the Post-Harvest techniques w.r.t. preparation of amla candy and alepak (Zinger wadi), aloe-vera gel.	1 P
13	To study the vertical farming structures for its application in urban agriculture or vertical gardening.	1 P
14	Demonstration of Hydroponics and aeroponics.	1 P
15	Visit to the nursery for the exploration of exotic ornamental plants and preparation of visit report for their application in in-door gardening practices.	1 P
16	Visit to the plant based industry for exploring the products and byproducts of the industry and its importance in the economics.	1 P
17	Case study on ecological restoration of the any environmental site available in nearby locality.	1 P

**Note: Conduct any 15 practical's from the above mentioned list.**

**F.Y. B. Sc. Botany  
Semester - I**

COURSE DETAILS	COURSE CODE	COURSE TITLE	CREDITS
<b>Generic Elective (GE) / Open Elective (OE) - (1T = 2C) (Any one from basket)</b>	OE-101-BOT-T	Agro-tourism	<b>2 C</b>
	OE-102-BOT-T	Plants and Human Welfare	
	OE-103-BOT-T	Agriculture for Competitive Exams	



**F. Y. B. Sc. Botany [Semester - I]**  
**Course Category – Open Elective / Generic Elective (OE)**  
**Course Code – OE-101-BOT-T**  
**Course Title: Agro-Tourism**

**[No. of Credits: 2 C]**

**[No. of Lectures: 30 L]**

**Objectives:**

1. Define agro-tourism and explain its significance in the context of sustainable tourism and rural development.
2. Study various agro-tourism models and best practices from around the world, including farm stays, farm-to-table experiences, and agri-tourism festivals.
3. Learn how to plan, develop, and manage agro-tourism businesses, including marketing strategies, customer service, and financial management.
4. Understand the role of agro-tourism in promoting sustainable agriculture practices, conservation of natural resources, and preservation of rural heritage.
5. Explore strategies for engaging and collaborating with local communities, farmers, and stakeholders to create authentic and meaningful agro-tourism experiences.

**Outcomes:**

1. Develop a comprehensive understanding of the concepts, principles, and practices of agro-tourism, including its history, development, and global trends.
2. Gain knowledge of sustainable agricultural practices and their importance in the context of agro-tourism, including organic farming, biodiversity conservation, and soil health management.
3. Acquire skills in planning, developing, and managing agro-tourism businesses, including business planning, marketing strategies, and customer relationship management.
4. Understand the importance of cultural and community engagement in agro-tourism, including the preservation of local traditions, heritage, and culinary practices.
5. Appreciate the role of agro-tourism in promoting environmental conservation, sustainable tourism practices, and responsible travel behavior.

**F. Y. B. Sc. Botany [Semester - I]**  
**Course Category – Open Elective / Generic Elective (OE)**  
**Course Code – OE-101-BOT-T**  
**Course Title: Agro-Tourism**

[No. of Credits: 2 C]

[No. of Lectures: 30 L]

Sr. No.	Topic Details	No. of Lectures
	<b>Credit I</b>	<b>15</b>
<b>1</b>	<b>Introduction to Agro-tourism</b> 1.1. Definition, nature and scope of agro-tourism. 1.2. Historical background and evolution of Agro-Tourism 1.3. Needs and opportunities of agro-tourism. 1.4. Importance of agro-tourism in rural development.	<b>03</b>
<b>2</b>	<b>Types of Agro-Tourism Activities</b> 2.1. Types of agro-tourism activities – Farm tours and visits; farm stays and rural accommodations; agricultural festivals and events. 2.2. Concept of food and agriculture tourism.	<b>03</b>
<b>3</b>	<b>Important Factors related to Agro-Tourism</b> 3.1. Location for agro-tourism center. 3.2. Geographical factors- relief, climate, drainage pattern, soil. 3.3. Socio-economic factors- Capital, transportation facilities, market, landholding of farmers, tradition, cropping pattern.	<b>05</b>
<b>4</b>	<b>Concerns of Agro-Tourism Centers</b> 4.1. Criteria to start Agro-Tourism centers - Infrastructure Facilities, livestock, Recreation facilities, Other Miscellaneous. 4.2. Benefits of Agro-Tourism Centers. 4.3. Challenges of the Agro-Tourism centers.	<b>04</b>
	<b>Credit II</b>	<b>15</b>
<b>5</b>	<b>Activities in Agro-Tourism centers</b> 5.1. Animal Feeding, Guided field visits and tour, Watching domestic animals, seasonal crop festival. 5.2. Rural Festival/Jatra, Marketing of Farmer's produce (local /organic products), Milking the Cow and Buffalos, Religious Temple visits. 5.3. Swimming at well, ponds or river, fishing, Local site seeing. 5.4. Rural/folk games, dance, music etc. - Bullock cart, Bicycle, Tractor rides. <i>Vittidandu, Surparambhya, Kabaddi, Langadi, Kho-Kho, Bullock ploughing, Lagore &amp; Gallori.</i> 5.5. Adventure activities- mountaineering, trekking, river crossing, cycling etc.	<b>05</b>
<b>6</b>	<b>Agro-Tourism policies</b> 6.1. Agro-Tourism policies in Maharashtra state. 6.2. Maharashtra Krishi Paryatan Vistar Yojana- MKPVY 6.3. Introduction and the concept. 6.4. Guidelines for approval and Guidelines of agro- tourism. 6.5. Application form for registration. 6.6. Checklist of facilities for approval. 6.7. Declaration by the farmer. 6.8. Undertaking by the farmer. 6.9. Performa for police verification.	<b>07</b>

7	<b>Tourism Marketing strategy</b> 7.1. Use of Social Media, Print Media, Attractive booking policies (for group/company/corporate etc.) 7.2. Website/Apps development for online booking and marketing.	03
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**F. Y. B. Sc. Botany [Semester - I]****Course Category – Open Elective (OE) / Generic Elective (GE)****Course Code – OE-102-BOT-T****Course Title: Plants and Human Welfare****[No. of Credits: 2 C]****[No. of Lectures: 30 L]****Objectives:**

1. Explore the diverse range of plant-based resources that contribute to human welfare, including food, medicine, fuel, and construction materials.
2. Study the medicinal properties of plants and their applications in traditional and modern medicine, including the development of pharmaceuticals and herbal remedies.
3. Learn about sustainable practices for the cultivation, harvesting, and utilization of plant resources to ensure their long-term availability and ecological conservation.
4. Understand the role of plants in providing essential nutrients and promoting food security, including the cultivation of nutritious crops and traditional food systems.
5. Explore the environmental benefits of plants, such as carbon sequestration and soil conservation, as well as their economic contributions through agriculture, forestry, and horticulture.

**Outcomes:**

1. Develop a comprehensive understanding of the diversity of plant species and their utility in various aspects of human life, including food, medicine, shelter, and clothing.
2. Gain knowledge about medicinal plants, their active compounds, and their therapeutic uses in traditional and modern medicine.
3. Acquire awareness of sustainable practices in plant resource management, including conservation, cultivation, and utilization, to ensure long-term benefits for both humans and the environment.
4. Appreciate the significance of traditional knowledge systems related to plants and their role in preserving cultural heritage and biodiversity.
5. Develop critical thinking and problem-solving skills to evaluate the ethical, social, and environmental implications of plant use and propose sustainable solutions.

**F. Y. B. Sc. Botany [Semester - I]****Course Category – Open Elective (OE) / Generic Elective (GE)****Course Code – OE-102-BOT-T****Course Title: Plants and Human Welfare****[No. of Credits: 2 C]****[No. of Lectures: 30 L]**

Sr. No.	Topic Details	No. of Lectures
	<b>Credit I</b>	<b>15</b>
<b>1</b>	<b>Introduction</b> 1.1. Origin of Cultivated Plants- Concept of Centers of Origin. 1.2. Domestication of plants and origin of agriculture. 1.3. Major and Minor food yielding Crops – Cereals, Pulses, Oil Seeds, Vegetables and Fibers.	<b>04</b>
<b>2</b>	<b>Cereals and Pulses</b> 2.1. Introduction and definition. 2.2. Cereals and Millets - Uses and byproducts of Wheat, Rice, Maize, Jowar, Bajara and Nachani. 2.3. Non-cereals - Uses and byproducts of Potato, Tapioca and Arrowroot. 2.4. Pulses - Uses and byproducts of Bengal gram, Pigeon Pea, Moong bean, Udid, Soybean, etc. 2.5. Importance of cereals, millets and pulses in human diet.	<b>06</b>
<b>3</b>	<b>Oils and Fats</b> 3.1. Introduction 3.2. Uses of edible oil yielding plants - Groundnut, Safflower, Mustard, Sesame, Coconut, Sunflower, Soybean, Rice-bran. 3.3. Traditional Methods of oil extraction and its health benefits 3.4. Non edible oil yielding plants- Neem oil, Karanj oil, Castor oil	<b>05</b>
	<b>Credit II</b>	<b>15</b>
<b>3</b>	<b>Vegetables and Fruits</b> 3.1. Introduction 3.2. Vegetables - Classification (as per parts used), Uses, processed byproducts of vegetables. 3.3. Fruits - Uses, processed byproducts of fruits – Mango, Grapes, Banana, Cashew Nut, Custard apple, Papaya, Guava, Lemon, Orange, etc. 3.4. Scope and importance of processed vegetables and fruits.	<b>05</b>
<b>4</b>	<b>Spices and Condiments</b> 4.1. Introduction, difference between spices and condiments 4.2. Importance of spices and condiments in diet - Turmeric, Ginger, Red Chilli, Coriander, Curry leaves, Clove, Saffron, Cardamom, Nutmeg, Cinnamon, Black pepper, Mustard, etc.	<b>05</b>
<b>5</b>	<b>Beverages</b> 5.1. Definition, types (alcoholic and non-alcoholic) 5.2. Processing of beverages – Wine production (Banana and Grapes), Tea Production and coffee production	<b>05</b>

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**F. Y. B. Sc. Botany [Semester - I]****Course Category – Open Elective (OE) / Generic Elective (GE)****Course Code – OE-103-BOT-T****Course Title: Agriculture for Competitive Exam****[No. of Credits: 2 C]****[No. of Lectures: 30 L]****Objectives:**

1. Provide a thorough coverage of important agricultural topics relevant to competitive exams, including agronomy, horticulture, plant breeding, soil science, and agricultural economics.
2. Provide high-quality study material, resources, and practice questions to help students prepare effectively for competitive exams.
3. Focus on building a strong foundation in key agricultural concepts, principles, and theories to help students understand and solve complex problems.
4. Conduct regular practice sessions and mock tests to help students improve their time management, accuracy, and confidence in answering exam questions.
5. Provide updates on current affairs, new developments, and technologies in agriculture to ensure students are aware of the latest trends and issues in the field.

**Outcomes:**

1. Develop a comprehensive understanding of key agricultural concepts, theories, and practices relevant to competitive exams.
2. Develop the ability to analyse and solve complex agricultural problems using critical thinking and problem-solving skills.
3. Improve time management skills to effectively answer exam questions within the allotted time frame.
4. Develop effective test-taking strategies to improve performance in competitive exams.
5. Build confidence in tackling questions related to agriculture, agronomy, horticulture, and other related fields in competitive exams.



**F. Y. B. Sc. Botany [Semester - I]****Course Category – Open Elective (OE) / Generic Elective (GE)****Course Code – OE-103-BOT-T****Course Title: Agriculture for Competitive Exam****[No. of Credits: 2 C]****[No. of Lectures: 30 L]**

Sr. No.	Topic Details	No. of Lectures
	<b>Credit I - Basics of Agriculture</b>	<b>15</b>
<b>1</b>	1.1. Definition, meaning and branches of Agriculture. 1.2. Factors affecting crop production. 1.3. Cropping Systems: Definition and types of cropping systems. 1.4. Meteorology: weather parameters.	<b>02</b>
<b>2</b>	2.1. Sources of water. 2.2. Absorption and movement of water in soil. 2.3. Soil moisture constants. 2.4. Forms of soil water. 2.5. Factors affecting available soil moisture. 2.6. Absorption of soil moisture by plant.	<b>03</b>
<b>3</b>	3.1. Water requirement. 3.2. Irrigation requirement of crops. 3.3. Factors affecting water requirement. 3.4. Measurement of irrigation. 3.5. Water use efficiency. 3.6. Importance of drainage and their types. 3.7. Effect of drainage on soil and crop growth.	<b>03</b>
<b>4</b>	4.1. Food production and consumption trends in India. 4.2. Food security and growing population. 4.3. NFSM and other food security related Government Initiatives. 4.4. Availability of food grains, per capita expenditure on food. 4.5. Food based dietary approaches to eliminate hunger. 4.6. Protein Energy Malnutrition or Protein Calorie Malnutrition (PEM or PCM). 4.7. HRD in context of work capacity of women and children.	<b>05</b>
<b>5</b>	5.1. Geo-informatics. 5.2. Crop discrimination and Yield monitoring. 5.3. Remote sensing concepts and application in agriculture. 5.4. Global positioning system (GPS).	<b>02</b>
	<b>Credit II - Act and Laws related to Agriculture</b>	<b>15</b>
<b>6</b>	<b>Maharashtra land revenue code</b> 6.1. Classification of land occupancies. 6.2. Responsibilities and duties of revenue officer. 6.3. Use of lands for agriculture and non- agriculture. 6.4. Encroachment of land, Revenue surveys. 6.5. Assessment and settlement of land revenue.	<b>04</b>
<b>7</b>	<b>Tenancy and agricultural lands act</b> 7.1. Concept of tenancy. 7.2. Right of tenancy. 7.3. Condition of purchase of agriculture land in Maharashtra.	<b>03</b>



	7.4. Sale of tenanted land. 7.5. Confiscation of powers of revenue officers.	
8	<b>Land acquisition acts</b> 8.1. Essential commodities act in relation to cotton, sugarcane, food grains. 8.2. Right to Fair compensation and Transparency in Land Acquisition. 8.3. Rehabilitation and Resettlement Act, 2013.	02
9	<b>Scopes, benefits coverage and limitations of the amendments</b> 9.1. Agriculture Pest and Disease Act (1950) 9.2. Prevention of Food Adulteration Act (1954) 9.3. Food production order Act (1956) 9.4. Asian Development Bank Act (1966) 9.5. Indian Seeds Act (1966) 9.6. Vegetable Oil Product Act (1967) 9.7. Insecticides Act (1968) 9.8. Agriculture Produce Market Act (1972) 9.9. Meat Food Products Order (1973) 9.10. Vegetable Oil Product (standard of quality) Order (1975) 9.11. Regional Rural Banks Act (1976) 9.12. Indian Veterinary Council Act (1984) 9.13. Consumer Protection Act (2019) 9.14. Indian Fisheries Act (1897) 9.15. Central Agricultural Universities Act (1992) 9.16. Destructive insects and Pests (Amendment and Validation) Act (1992) 9.17. The Protection of Plant Varieties and Farmers' Rights Act (2001) 9.18. Biodiversity Act (2002).	06

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**F.Y. B. Sc. Botany  
Semester - I**

COURSE DETAILS	COURSE CODE	COURSE TITLE	CREDITS
<b>Skill Enhancement Courses (SEC) - (1T / 1P = 2C) (Any one from basket)</b>	SEC-101-BOT-P	Flower Design Techniques	<b>2 C</b>
	SEC-102-BOT-P	Post-Harvest Technology	
	SEC-103-BOT-P	Algal Technology	

**F. Y. B. Sc. Botany [Semester - I]**  
**Course Category – Skill Enhancement Course (SEC)**  
**Course Code – SEC-101-BOT-P**

**Course Title: Flower Design Techniques**

**[No. of Credits: 2 C]**

**[No. of Lectures: 60 L]**

**Objectives:**

1. Learn the basic principles and techniques of floral design, including line, form, balance, and colour harmony.
2. Develop advanced skills in creating various floral arrangements, such as bouquets, centrepieces, wreaths, and corsages, using different types of flowers and foliage.
3. Understand the proper care and handling of flowers, including selection, conditioning, and storage, to ensure longevity and freshness in arrangements.
4. Explore creative concepts and trends in floral design, such as contemporary styles, themed arrangements, and use of unconventional materials.
5. Practice professional presentation skills, including packaging, labelling, and displaying floral arrangements, for various occasions and settings.

**Outcomes:**

1. Develop proficiency in creating various basic floral arrangements, including hand-tied bouquets, vase arrangements, and table centrepieces, using proper techniques and principles of design.
2. Acquire advanced skills in creating complex floral designs, such as cascading bouquets, floral arches, and large-scale installations, demonstrating creativity and attention to detail.
3. Gain knowledge of different floral design styles, such as traditional, contemporary, and seasonal, and stay updated with current trends in the floral industry.
4. Understand the principles of flower selection, care, and handling, including proper conditioning, storage, and use of floral foam and other design tools.
5. Develop the ability to create customized floral designs tailored to specific occasions, themes, and client preferences, demonstrating creativity and versatility in design.

**F. Y. B. Sc. Botany [Semester - I]**  
**Course Category – Skill Enhancement Course (SEC)**  
**Course Code – SEC-101-BOT-P**

**Course Title: Flower Design Techniques**

**[No. of Credits: 2 C]**

**[No. of Lectures: 60 L]**

Sr. No.	Topic Details	Weightage
1	To study the structure of typical flower.	1P
2	To study the seasonal flowers and their characteristics.	1P
3	To study the types/styles of flower arrangements (e.g., Ikebana, European, Contemporary) with the help of ICT tools.	1P
4	To demonstrate the essential tools and materials used in flower arrangement.	1P
5	To study the selection of flowers and foliage types used for flower arrangement.	2P
6	Demonstration of drying and preservation of flowers.	1P
7	Preparation of traditional flower designs - garland, Gajra, Veni etc.	1P
8	Preparation of floral Rangoli.	1P
9	To study the different type of bouquets.	2P
10	To study the methods of vase life improvement of cut flowers.	1P
11	Visit to floriculture industry and study of floral business economics.	2P
12	To study the role of flower arrangement in event management.	1P

**F. Y. B. Sc. Botany [Semester - I]**  
**Course Category – Skill Enhancement Course (SEC)**  
**Course Code – SEC-102-BOT-P**

**Course Title: Post-Harvest Technology**

**[No. of Credits: 2 C]**

**[No. of Lectures: 60 L]**

**Objectives:**

1. Understand the physiological and biochemical changes that occur in harvested crops and their impact on quality and shelf life.
2. Learn proper post-harvest handling techniques, including harvesting, sorting, grading, packaging, and storage, to minimize losses and maintain product quality.
3. Gain knowledge of post-harvest treatments, such as washing, waxing, and controlled atmosphere storage, to extend the shelf life of perishable products.
4. Implement quality control measures to ensure that harvested products meet market standards and consumer expectations.
5. Explore and develop value-added products from harvested crops, such as processing fruits into jams or juices, to increase profitability and reduce waste.

**Outcomes:**

1. Develop proficiency in post-harvest handling techniques, including sorting, grading, and packaging, to maintain product quality and minimize losses.
2. Acquire knowledge of various post-harvest treatments, such as washing, waxing, and irradiation, and their effects on shelf life and quality of harvested products.
3. Understand the importance of quality control measures in post-harvest management and learn how to implement them effectively to ensure product quality and safety.
4. Gain the ability to implement proper storage techniques, such as cold storage and controlled atmosphere storage, to prolong the shelf life of perishable products.
5. Develop skills in developing value-added products from harvested crops, such as processing fruits into juices or snacks, to add value and increase marketability.

**F. Y. B. Sc. Botany [Semester - I]**  
**Course Category – Skill Enhancement Course (SEC)**  
**Course Code – SEC-102-BOT-P**

**Course Title: Post-Harvest Technology**

**[No. of Credits: 2 C]**

**[No. of Lectures: 60 L]**

Sr. No.	Topic Details	Weightage
1	To demonstrate the methods of post-harvest handling - Harvesting, Precooling, Sorting, Grading, Packaging with the help of ICT Tools	1 P
2	To demonstrate the methods of Sorting and Grading	1 P
3	To study the preparation of Jam, Jellies and Candies.	3 P
4	To demonstrate the equipment's and technology used in Food Processing with the help of ICT tools	1 P
5	To study the preparation of Tomato sauce, puree and ketch up	2 P
6	To study the preparation of crush, squash and syrup	3 P
7	To study the preparation of pickles from fruits /vegetables	1 P
8	To study the preparation of Aloe vera gel	1 P
9	Visit to fruit processing industry/ cold storage/ fruits ripening unit	2 P

**F. Y. B. Sc. Botany [Semester - I]**  
**Course Category – Skill Enhancement Course – Practical (SECP)**  
**Course Code – SEC-103-BOT-P**  
**Course Title: Algal Technology**

**[No. of Credits: 2 C]**

**[No. of Lectures: 60 L]**

**Objectives:**

1. Gain an understanding of algal biology, including the diversity of algae species, their classification, and their ecological roles.
2. Learn various techniques for cultivating algae, including open pond systems, closed photo-bioreactors, and hybrid systems, to maximize biomass production.
3. Acquire skills in harvesting algae biomass and processing it into valuable products, such as biofuels, biofertilizers, and nutraceuticals.
4. Understand the potential of algae in bioremediation, including their ability to remove pollutants from water and air, and develop skills in applying algal technology for environmental remediation.
5. Develop skills in the development of value-added products from algae, such as cosmetics, pharmaceuticals, and food additives, to explore the commercial potential of algal technology.

**Outcomes:**

1. Develop proficiency in cultivating algae using various methods, including open pond systems and photobioreactors, to maximize biomass production.
2. Acquire expertise in harvesting algae biomass and processing it into valuable products, such as biofuels, biofertilizers, and high-value chemicals.
3. Gain knowledge of algal biotechnology techniques, such as genetic engineering and strain selection, to enhance algal productivity and product quality.
4. Develop skills in using algae for bioremediation purposes, including the removal of pollutants from wastewater and the sequestration of carbon dioxide from the atmosphere.
5. Develop the ability to develop innovative algal-based products, such as cosmetics, pharmaceuticals, and functional foods, to meet market demands and promote sustainable development.

**F. Y. B. Sc. Botany [Semester - I]**  
**Course Category – Skill Enhancement Course – Practical (SECP)**  
**Course Code – SEC-103-BOT-P**  
**Course Title: Algal Technology**

**[No. of Credits: 2 C]**

**[No. of Lectures: 60 L]**

Sr. No.	Title of the Practical	No. of Practical
1	To study the methods of collection, preservation and staining of algae.	1 P
2	Study of algae from fresh water bodies.	1 P
3	Study of thallus organization of - Unicellular algae - Non motile: <i>Chlorella</i> and Motile: <i>Chlamydomonas</i> ; Colonial algae - <i>Volvox</i> ; Filamentous algae : <i>Anabaena / Spirogyra</i> ; Siphonous algae : <i>Caulerpa / Chara</i> ; Parenchymatous algae: <i>Sargassum / Gracillaria</i> .	2 P
4	Preparation of culture media for fresh water algae - Bolds Basal medium for Blue Green Algae, Modified Chu-10 medium, Nitsch medium. (Demonstration).	1 P
5	Isolation of algae by dilution and streak culture technique (Demonstration).	1 P
6	Cultivation of <i>Spirulina</i> .	1 P
7	Study of commercial products of <i>Spirulina</i> .	1 P
8	Utilization of algae in Biofuel, agriculture and pharmaceuticals industries. (Demonstration).	1 P
9	Utilization of algae in food and fodder industry, algae and space research. (Demonstration).	1 P
10	Preparation of culture media for BGA.	1 P
11	Preparation of Blue Green Algae as a Biofertilizers.	1 P
12	Study of waste water algae.	1 P
13	Study of algal bioluminescence (Demonstration).	1 P
14	Visit to nearby ponds rivers lakes and polluted habitats to study fresh water or marine water algal habitats and submission of visit report.	1 P



**F.Y. B. Sc. Botany  
Semester - I**

<b>COURSE DETAILS</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CREDITS</b>
<b>Indian Knowledge Systems (IKS) - (1T = 2 C)</b>	IKS-101-T	Generic	<b>2 C</b>
<b>Ability Enhancement Course (AEC) - (1T = 2 C)</b>	AEC-101-ENG-T	English	<b>2 C</b>
<b>Value Education Courses (VEC) - (1T = 2 C)</b>	VEC-101-ENV-T	Environmental Awareness	<b>2 C</b>

**F.Y. B. Sc. Botany  
Semester – II**

COURSE DETAILS	COURSE CODE	COURSE TITLE	CREDITS
<b>Subject 1 - (1T + 1P) x 2 C = 4 C</b>	BOT-151-T	Basics of Plant Sciences	<b>2 C</b>
	BOT-152-P	Practical Based on BOT-151-T	<b>2 C</b>
<b>Subject 2 - (1T + 1P) x 2 C = 4 C</b>	Subject 2 -T	-----	<b>2 C</b>
	Subject 2 -P	-----	<b>2 C</b>
<b>Subject 3 - (1T + 1P) x 2 C = 4 C</b>	Subject 3 -T	-----	<b>2 C</b>
	Subject 3 -P	-----	<b>2 C</b>

**F. Y. B. Sc. Botany [Semester - II]****Course Code - BOT-151-T****Course Title: Basics of Plant Sciences****[No. of Credits: 2 C]****[No. of Lectures: 30 L]****Objectives:**

1. Develop a comprehensive understanding of the concept and importance of plant diversity, including an overview of the plant kingdom and the classification of various plant groups.
2. Gain knowledge about the characteristics, economic importance, and biotechnological applications of algae, including their use in food, industry, and bioremediation.
3. Understand the ecological roles and economic importance of fungi, including their roles in nutrient cycling, symbiotic relationships, and applications in food production and industry.
4. Explore the characteristics, ecological significance, and economic uses of lichen and bryophytes, including their roles in environmental monitoring, soil formation, and horticulture.
5. Gain insight into the characteristics and ecological and economic importance of pteridophytes, gymnosperms, and angiosperms, including their roles in ecosystems, agriculture, and industry.

**Outcomes:**

1. Students will demonstrate a clear understanding of the definition and concept of plant diversity, including the general outline of the plant kingdom and its major groups.
2. Students will be able to identify and describe the characteristics of algae, and explain their economic and biotechnological importance, including their roles in food, industry, and future research prospects.
3. Students will understand the ecological roles of fungi in nutrient cycling and symbiotic relationships, and recognize their economic importance in industry, agriculture, and food production.
4. Students will identify different types of lichens and bryophytes, and describe their ecological significance and economic uses, including their roles in environmental monitoring and traditional medicine.
5. Students will demonstrate knowledge of the characteristics and importance of pteridophytes, gymnosperms, and angiosperms, including their ecological roles, economic significance, and contributions to ecosystems and human welfare.

**F. Y. B. Sc. Botany [Semester - II]****Course Code - BOT-151-T****Course Title: Basics of Plant Sciences****[No. of Credits: 2 C]****[No. of Lectures: 30 L]**

Sr. No.	Topic Details	No. of Lectures
	<b>Credit I - PLANT KINGDOM</b>	<b>15</b>
<b>1</b>	<b>Introduction to Plant Diversity</b> 1.1. Definition and concept of Plant Diversity. 1.2. General outline of Plant Kingdom.	<b>01</b>
<b>2</b>	<b>Algae</b> 2.1. Introduction, definition and characters of Algae, suitable examples. 2.2. Economic and Biotechnological Importance of Algae – 2.2.1. Algae as food: nutritional value and culinary uses. 2.2.2. Algae in industry: biofuels, pharmaceuticals, and bioremediation. 2.2.3 Biotechnological applications: algae cultivation, genetic engineering, and algae-based products. 2.2.4. Future prospects and challenges in algae research and utilization.	<b>02</b>
<b>3</b>	<b>Fungi</b> 3.1. Introduction, definition and general characters of fungi; suitable examples. 3.2. Ecological and Economic Importance of Fungi – 3.2.1. Fungi in nutrient cycling and decomposition. 3.2.2. Symbiotic relationships: mycorrhizae, lichens. 3.2.3. Pathogenic fungi and their impact on plants, animals and humans. 3.2.4. Economic importance of fungi in industry and agriculture. 3.2.5. Fungi in food production and fermentation processes.	<b>02</b>
<b>4</b>	<b>Lichen</b> 4.1. Introduction; definition and general characters of lichen; Types– crustose, foliose and fruticose. 4.2. Importance of Lichen – 4.2.1. Ecological significance: contribution to nutrient cycling, soil formation, and erosion control; Role of lichens as bio-indicators of environmental health. 4.2.2. Cultural significance: use in traditional medicine, dyeing, and food for some cultures 4.2.3. Economic significance: use in pharmaceuticals, cosmetics, and environmental monitoring.	<b>02</b>
<b>5</b>	<b>Bryophytes</b> 5.1. Introduction; definition and general characters; suitable examples. 5.2. Ecological and Economic Importance of Bryophytes – 5.2.1. Ecological Importance of bryophytes - in Ecosystems, Soil	<b>02</b>

	<p>formation and Stabilization, Habitat creation, Water retention and nutrient cycling.</p> <p>5.2.2. Economic Importance of bryophytes – role of mosses in horticulture and landscaping, traditional and modern uses of bryophytes in medicine, economic value of bryophytes in industries such as forestry and agriculture.</p>	
6	<p><b>Pteridophytes</b></p> <p>6.1. Introduction; definition and general characters; suitable examples.</p> <p>6.2. Ecological and Economic Importance of Pteridophytes –</p> <p>6.2.1. Ecological Importance of Pteridophytes - Role of Pteridophytes in plant evolution; transition from aquatic to terrestrial habitat; Contribution to ecosystem diversity; Role in soil stabilization and conservation.</p> <p>6.2.2. Economic Importance of Pteridophytes – Ornamental uses: landscaping and indoor plants; Medicinal uses: traditional and modern applications.</p>	02
7	<p><b>Gymnosperms</b></p> <p>7.1. Introduction; definition and general characters of gymnosperms; suitable examples.</p> <p>7.2. Ecological and Economic Importance –</p> <p>7.2.1. Ecological roles of gymnosperms in various ecosystems; adaptations to environment.</p> <p>7.2.2. Economic significance: timber, paper, resin, ornamental and medicinal uses, etc.</p>	02
8	<p><b>Angiosperms</b></p> <p>8.1. Introduction; definition and general characters of angiosperms; suitable examples.</p> <p>8.2. Ecological and Economic importance of Angiosperms: –</p> <p>8.2.1. Ecological Importance of Angiosperms: Role as Primary producers, in habitat and biodiversity, soil conservation, water regulation; pollinator support.</p> <p>8.2.2. Economic Importance of Angiosperms: Food, Fodder, Fiber, Medicine, Timber, Ornamental, Horticulture and Landscaping, Biofuel production, Ecosystem services (carbon sequestration, oxygen production, soil stabilization, and water filtration), etc.</p>	02
<b>Credit II – PLANT MORPHOLOGY</b>		<b>15</b>
9	<p><b>Introduction to Plant Morphology</b></p> <p>9.1. Introduction, Definition; Types of morphology – Descriptive and Interpretative.</p> <p>9.2. Importance of Morphology.</p>	01
10	<p><b>Root Morphology</b></p> <p>10.1. Definition, Parts / regions of root; Types – Tap root and fibrous / adventitious root.</p> <p>10.2. Modifications of roots – Aerial roots (Hanging roots) with velamen tissue in Epiphytes; Haustorial (sucking) roots in Parasites - <i>Cuscuta</i>,</p>	02

	<p>Respiratory roots / Pneumatophores in Mangrove; Fleshy / Storage roots - Conical, Fusiform, Napiform, and Tuberos roots; Roots modified for Mechanical supports – Stilt, Prop, Climbing, and Clinging roots with examples.</p> <p>10.3. Functions of roots.</p>	
11	<p><b>Stem Morphology</b></p> <p>11.1. Definition, Parts of stem – nodes, internodes, buds, types of buds (Apical, Axillary, Accessory Adventitious and Floral).</p> <p>11.2. Types of stem – a) Erect – Strong, Weak (Creepers, Trailers and Climbers); b) Prostrate – Procumbent, Decumbent and Diffuse; Modifications of stem – a) Aerial – Phylloclade, Bulbil b) Sub-aerial – Runner, Sucker, Stolon, Offset; c) Underground – Rhizome, Corm, Tuber, Bulb (Tunicated and Scaly).</p> <p>11.3. Functions of stem.</p>	02
12	<p><b>Leaf Morphology</b></p> <p>12.1. Definition, Parts of leaf; Stipule, Petiole, Leaf margins, Apices and Base, Surface, Venation, Phyllotaxy, Leaf duration (Caducous, Deciduous, Persistent- Evergreen).</p> <p>12.2. Types of leaves – Simple and Compound – Pinnately (Unipinnate – Paripinnate and Imparipinnate; Bipinnate, Tripinnate and Decomound) and Palmately (Uni-, Bi-, Tri-, Quadri- and Multifoliate); Leaf Modifications: Tendrils, Spines, Phyllode, Scaly, Reproductive, Trap leaves.</p> <p>12.3. Functions of leaves.</p>	02
13	<p><b>Morphology of Inflorescence</b></p> <p>13.1. Definition, Parts of Inflorescence.</p> <p>13.2. Types of Inflorescence – a) Racemose – i) Main Axis Elongated – Raceme, Spike, Catkin, Spadix; ii) Main Axis Shortened – Umbel and Corymb; iii) Main Axis Flattened – Capitata, Head / Capitulum; b) Cymose – Solitary, axillary, Terminal, Uniparous (Monochasial) – Helicoid and Scorpoid, Biparous (Dichasial), Multiparous (Polychasial) Cyme; c) Special Type – Verticilliaster, Cyathium, Hypanthodium.</p>	02
14	<p><b>Morphology of Flower</b></p> <p>14.1. Definition, typical structure of flower.</p> <p>14.2. Types of flowers based on Symmetry, Insertion of floral whorls on thalamus.</p> <p>14.3. Floral whorls –</p> <p>l) Accessory whorls:</p> <p>a) Calyx: member - sepals, number, cohesion, types of calyx; Modifications of calyx – Petaloid, Pappus, Spurred;</p> <p>b) Corolla: member – petals: Claw and Limb; number, cohesion, types / forms of corolla – Polypetalous Regular – Cruciform, Caryophyllous, Rosaceous; Polypetalous irregular – Papillionaceous; Gamopetalous Regular – Tubular, Infundibuliform, Campanulate, Salvar shaped, Rotate; Gamopetalous Irregular – Bilabiate, Personate and Ligulate;</p>	05

	<p>c) Perianth: member – tepals, number, cohesion, modifications – sepaloid and petaloid tepals. Aestivation – Definition; aestivation in calyx, corolla and perianth; types of aestivation.</p> <p>II) Necessary / Essential whorls:</p> <p>a) Androecium: member – stamen, Structure of stamen; Cohesion and Adhesion;</p> <p>b) Gynoecium: member – Carpel / Pistil; structure of carpel; Types of gynoecium based on carpel number and fusion; Placentation- Definition; types – Marginal, Parietal, Axile, Free-central, Basal, superficial.</p>	
<b>15</b>	<p><b>Morphology of Fruit and Seed</b></p> <p>15.1. Fruit: Definition and parts of fruit.</p> <p>15.2. Seed: Definition, Parts of typical seed.</p>	<b>01</b>

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**F. Y. B. Sc. Botany [Semester - II]****Course Code - 152-BOT-P****Course Title: Practical Based on BOT 151-BOT-T****[No. of Credits: 2 C]****[No. of Lectures: 60 L]****Objectives:**

1. To understand the phylogenetic relationships and evolutionary significance of diverse plant groups, fostering an appreciation for plant biodiversity and conservation.
2. To analyse the external and internal morphology of vegetative organs in representative plant groups, such as algae, fungi, bryophytes, pteridophytes, gymnosperms, and angiosperms, enhancing understanding of plant anatomy and physiology.
3. To examine and describe the types and modifications of roots, stems, and leaves, highlighting their structural adaptations and functions in different plant species.
4. To study the morphology of inflorescences, flowers, fruits, and seeds, understanding their role in plant reproduction and development, and identifying key characteristics for plant identification and classification.
5. To explore the variation in floral structures among different plant families, focusing on the arrangement and morphology of floral whorls.
6. To participate in botanical excursions to nearby localities, studying the vegetation and diversity among various plant groups in their natural habitats, fostering fieldwork skills and ecological awareness.

**OUTCOMES:**

1. Students will be able to identify and classify a wide range of plant species from different habitats, understanding their ecological roles and evolutionary relationships.
2. Students will be able to analyze and interpret the external and internal morphology of vegetative organs in various plant groups, enhancing their knowledge of plant anatomy and physiology.
3. Students will gain practical skills in examining and describing the types and modifications of roots, stems, and leaves, understanding their structural adaptations and ecological functions.
4. Students will acquire the ability to investigate and describe the reproductive structures and life cycles of different plant groups, including algae, fungi, bryophytes, pteridophytes, gymnosperms, and angiosperms.
5. Students will understand the morphology and function of inflorescences, flowers, fruits, and seeds, and will be able to identify key characteristics used in plant identification and classification.
6. Students will gain hands-on experience in botanical fieldwork, including conducting botanical excursions, documenting vegetation, and studying plant diversity in natural habitats.

**F. Y. B. Sc. Botany [Semester - II]****Course Code - 152-BOT-P****Course Title: Practical Based on BOT 151-BOT-T****[No. of Credits: 2 C]****[No. of Lectures: 60 L]**

Sr. No.	Title of the Practical	No. of Practical
1	Study of life cycle of <i>Spirogyra</i> w.r.t. thallus, cell structure and reproduction.	1 P
2	Study of life cycle of <i>Albugo</i> w.r.t. host, occurrence, morphology and reproduction.	1 P
3	Study of forms of lichens on the basis of their external morphology – Crustose, Foliose and Fruticose.	1 P
4	Study of life cycle of <i>Riccia</i> w.r.t. external and internal morphology of thallus and reproduction.	1 P
5	Study of <i>Nephrolepis</i> w.r.t. external morphology of sporophyte; Internal morphology of rachis and leaflet/ pinna passing through sori.	1 P
6	Study of <i>Cycas</i> w.r.t. external morphology of sporophyte; Internal morphology of leaflet / pinna; Reproduction – male and female cone.	1 P
7	Study of comparative account of Dicotyledonous and Monocotyledonous plants with suitable examples.	1 P
8	Study of root w.r.t. its types and modifications.	1 P
9	Study of stem w.r.t. its types and modifications.	2 P
10	Study of leaf w.r.t. its types and modifications.	1 P
11	Study of types of inflorescences.	1 P
12	Study of typical flower w.r.t. floral whorls calyx, corolla, perianth, androecium, gynoecium ( <i>Hibiscus, Datura, Brassica, Glyricidia / Clitoria / Bean, Adhatoda / Ocimum, Polyanthus, Bouganvelia, Citrus, Sunflower, Cucurbita</i> )	1 P
13	Study of types of fruits.	1 P
14	Botanical Excursion to nearby locality to study the vegetation and diversity among various plant groups.	1 P

**F.Y. B. Sc. Botany  
Semester - II**

COURSE DETAILS	COURSE CODE	COURSE TITLE	CREDITS
<b>Generic Elective (GE) / Open Elective (OE) - (1P = 2 C) (Any one from basket)</b>	OE-151-BOT-P	Fruit Processing and Flower Arrangement	<b>2 C</b>
	OE-152-BOT-P	Mushroom technology	
	OE-153-BOT-P	Vertical and Terrace Gardening	

**F.Y.B.Sc. Botany [Semester-II]****Course Category – Generic Elective / Open Elective (OE)****Course Code – OE-151-BOT-P****Course Title: Fruit Processing and Flower Arrangement****[No. of Credits: 2 C]****[No. of Lectures: 60 L]****OBJECTIVES:**

1. To equip students with hands-on experience in various fruit processing techniques, such as canning, drying, freezing, and making jams, jellies, and preserves.
2. To explore the use of different preservatives, packaging techniques, and storage conditions that enhance the shelf life and safety of processed fruits.
3. To develop students' skills in designing and creating various types of flower arrangements, including bouquets, centerpieces, corsages, and wreaths.
4. To teach students the principles of floral design, such as balance, harmony, color theory, and the use of different floral materials and tools.
5. To encourage students to express their creativity through innovative and aesthetically pleasing flower arrangements.
6. To bridge the gap between theoretical knowledge and practical applications by exposing students to the fruit processing industry and the floral design market.

**OUTCOMES:**

1. Students will demonstrate the ability to perform various fruit processing techniques, such as canning, drying, freezing, and making jams, jellies, and preserves, ensuring the preservation of nutritional value, flavor, and texture of fruits.
2. Students will understand the chemical and biological processes involved in fruit spoilage and the methods used to prevent it. They will be able to apply different preservatives, packaging techniques, and storage conditions to enhance the shelf life and safety of processed fruits.
3. Students will be skilled in designing and creating various types of flower arrangements. They will apply principles of floral design and the use of different floral materials and tools.
4. Students will be able to express their creativity through innovative and aesthetically pleasing flower arrangements.
5. Students will bridge the gap between theoretical knowledge and practical applications by gaining exposure to the fruit processing industry and the floral design market.

**F.Y.B.Sc. Botany [Semester-II]****Course Category – Generic Elective / Open Elective (OE)****Course Code – OE-151-BOT-P****Course Title: Fruit Processing and Flower Arrangement****[No. of Credits: 2 C]****[No. of Lectures: 60 L]**

<b>Sr. No.</b>	<b>Practical</b>	<b>No. of Practical</b>
<b>1</b>	Identification of equipment and machinery used in preservation of fruits & vegetables	<b>1 P</b>
<b>2</b>	To study preservation by drying and dehydration	<b>1 P</b>
<b>3</b>	Preparation of Squash	<b>1 P</b>
<b>4</b>	Preparation of Jam	<b>1 P</b>
<b>5</b>	Preparation of Jelly	<b>1 P</b>
<b>6</b>	Preparation of Candy and preserve	<b>1 P</b>
<b>7</b>	Preparation of Ketchup	<b>1 P</b>
<b>8</b>	Study of tools used in flower arrangements.	<b>1 P</b>
<b>9</b>	Study of different types of architecture in the flower arrangements.	<b>1 P</b>
<b>10</b>	Preparation of different types of decorative flower-based arrangements	<b>1 P</b>
<b>11</b>	Study of vase life of flower	<b>1 P</b>
<b>12</b>	Preparation of basic tied bouquet	<b>1 P</b>
<b>13</b>	Preparation of Simple vase arrangement	<b>1 P</b>
<b>14</b>	Preparation of symmetrical triangle arrangement and asymmetrical crescent arrangement.	<b>1 P</b>
<b>15</b>	Visit to the botanical garden/ Flower show and festivals/Floral art museum and galleries	<b>1 P</b>

**F.Y.B.Sc. Botany [Semester-II]**  
**Course Category – Generic Elective / Open Elective (OE)**  
**Course Code – OE-152-BOT-P**

**Course Title: Mushroom technology**

**[No. of Credits: 2 C]**

**[No. of Lectures: 60 L]**

**OBJECTIVES:**

1. To provide students with a comprehensive understanding of the biology, taxonomy, and ecological roles of different mushroom species and familiarize them with the various types of edible and medicinal mushrooms, their nutritional benefits, and their economic importance.
2. To equip students with practical skills in mushroom cultivation, including substrate preparation, inoculation, spawn production, and environmental control.
3. To provide insights into the setup and management of a mushroom farm, including the selection of suitable cultivation sites, construction of mushroom houses, and implementation of hygiene and sanitation practices.
4. To educate students on post-harvest handling techniques, including cleaning, packaging, storage, and transportation of mushrooms to maintain their quality and extend shelf life.
5. To introduce students to the economic aspects of mushroom production, including cost analysis, market trends, and pricing strategies.
6. To inspire students to engage in research and innovation within the field of mushroom technology, exploring new cultivation techniques, substrate materials, and mushroom species.

**OUTCOMES:**

1. Students will demonstrate a thorough understanding of the biology, taxonomy, and ecological roles of different mushroom species, recognizing their nutritional and economic importance.
2. Students will acquire practical skills in various mushroom cultivation techniques, including substrate preparation, inoculation, spawn production, and environmental control, successfully cultivating different species.
3. Students will be able to set up and manage a mushroom farm, implementing effective hygiene and sanitation practices, pest and disease management strategies, and crop rotation to ensure high yield and quality.
4. Students will master post-harvest handling techniques, including cleaning, packaging, storage, and transportation, to maintain mushroom quality and extend shelf life. They will also be skilled in value-added processing, such as drying and canning.
5. Students will understand the economic aspects of mushroom production, including cost analysis and market trends.
6. Students will successfully apply their theoretical knowledge to practical scenarios, demonstrating the ability to solve problems and optimize mushroom production processes.
7. Students will develop entrepreneurial skills, including business planning and management, enabling them to start and manage their own mushroom cultivation enterprises.

**F.Y.B.Sc. Botany [Semester-II]****Course Category – Generic Elective / Open Elective (OE)****Course Code – OE-152-BOT-P****Course Title: Mushroom technology****[No. of Credits: 2 C]****[No. of Lectures: 60 L]**

<b>Sr. No.</b>	<b>Practical</b>	<b>No. of Practical</b>
<b>1</b>	To study the morphology of mushroom.	<b>2 P</b>
<b>2</b>	Demonstrate equipment's required for mushroom production	<b>1 P</b>
<b>3</b>	To demonstrate types of mushrooms.	<b>1 P</b>
<b>4</b>	Demonstrate preparation of spawn with the help of flow diagram	<b>1 P</b>
<b>5</b>	To Prepare any suitable bed for cultivation of Oyster mushroom	<b>2 P</b>
<b>6</b>	To demonstrate harvesting of mushrooms.	<b>1 P</b>
<b>7</b>	To perform any suitable method for mushroom preservation	<b>1 P</b>
<b>8</b>	Preparations of different types of Mushroom recipes. (Any two) Eg. Mushroom Pulao, Mushroom soup, mushroom Omelets, Mushroom Pakora, Mushroom curry, Mushroom pickles etc	<b>4 P</b>
<b>9</b>	Visit to Mushroom Growing Industry / Small scale unit and Submit the report at the time practical examination.	<b>2 P</b>

**F.Y.B.Sc. Botany [Semester-II]**  
**Course Category – Generic Elective / Open Elective (OE)**  
**Course Code – OE-153-BOT-P**

**Course Title: Vertical and Terrace Gardening**

**[No. of Credits: 2 C]**

**[No. of Lectures: 60 L]**

**OBJECTIVES:**

1. To provide students with a comprehensive understanding of the principles and benefits of vertical gardening and familiarize them with different types of vertical gardening.
2. To educate students on the basic requirements and materials needed for vertical gardening and the importance of controlled conditions in maintaining healthy vertical gardens.
3. To equip students with practical skills in preparing small and large scale vertical gardens and encourage creativity and sustainability by preparing vertical gardens using recyclable materials.
4. To introduce students to advanced vertical gardening techniques, such as hydroponic and aquaponics systems, teaching them the principles and setup of soil-less gardening.
5. To provide insights into permaculture and edible landscaping, teaching students the concepts and benefits of designing sustainable, food-producing gardens.
6. To educate students on the different irrigation systems and fertilizer application methods suitable for vertical gardens, ensuring efficient water and nutrient delivery.
7. To organize visits to vertical gardens, local nurseries, garden centres, workshops, and events on vertical gardening, providing students with practical exposure and industry insights.

**OUTCOMES:**

1. Students will be proficient in various methods of establishing vertical gardens for the selection to select appropriate structures based on environmental and spatial considerations.
2. Graduates will be adept at incorporating sustainable gardening practices, such as using recyclable materials and preparing kitchen waste manure, thereby promoting environmental stewardship and waste reduction in gardening.
3. Students will acquire hands-on experience in setting up and maintaining soil-less gardening systems such as hydroponics and aquaponics.
4. Participants will gain knowledge about permaculture principles and edible landscaping, equipping them with the skills to design and implement sustainable, productive green spaces that provide food resources and ecological benefits.
5. Students will learn efficient irrigation and fertilization techniques specific to vertical gardens, ensuring optimal plant growth and resource conservation.
6. Students will be prepared to engage with communities and share knowledge about vertical gardening techniques and benefits, fostering broader adoption of these practices and contributing to community well-being and urban beautification.



**F.Y.B.Sc. Botany [Semester-II]****Course Category – Generic Elective / Open Elective (OE)****Course Code – OE-153-BOT-P****Course Title: Vertical and Terrace Gardening****[No. of Credits: 2 C]****[No. of Lectures: 60 L]**

Sr. No.	Practical	No. of Practical
1	Study of vertical gardening and its types. (Demonstration).	1 P
2	Study of the basic requirements used for vertical gardening.	1 P
3	Preparation of the small and large A-shaped vertical garden.	1 P
4	Preparation of a Vertical Garden with recyclable material.	1 P
5	Preparation of container based vertical gardens.	1 P
6	Preparation of kitchen waste manure for vertical gardening.	1 P
7	Preparation of hydroponic and aquaponics gardening.	1 P
8	Preparation of green roof gardening. (Demonstration).	1 P
9	Study of the permaculture and edible landscaping.	2 P
10	Preparation of herb spiral and terrace vegetable garden.	1 P
11	Study of irrigation and fertilizer application	1P
12	Visit to vertical garden/ Local nurseries and garden centers/workshops and events on vertical gardening. Submit the report at the time practical examination	2 P
13	Visit to Private residency with rooftop gardens/ Green tokri	1 P

**F.Y. B. Sc. Botany**  
**Semester - II**

COURSE DETAILS	COURSE CODE	COURSE TITLE	CREDITS
<b>Skill Enhancement Courses (SEC) - (1T / 1P = 2C) (Any one from basket)</b>	SEC-151-BOT-P	Plant Preservation Techniques	<b>2 C</b>
	SEC-152-BOT-P	Millets for Sustainable Agriculture Development	
	SEC-153-BOT-P	Plant Propagation Techniques	

**F. Y. B. Sc. Botany [Semester - II]**  
**Course Category – Skill Enhancement Course – Practical (SECP)**  
**Course Code – SEC-151-BOT-P**

**Course Title: Plant Preservation Techniques**

**[No. of Credits: 2 C]**

**[No. of Lectures: 60 L]**

**OBJECTIVES**

1. Acquire knowledge about various tools and equipment essential for plant collection, focusing on their correct usage and maintenance to ensure efficient and safe botanical sampling.
2. Learn and apply different methods of drying plant specimens, to understand their applicability and effectiveness in preserving plant integrity.
3. Develop expertise in preparing pressed specimens for herbarium use, including techniques for pressing, drying, and long-term storage that ensure specimen preservation and usability for scientific research.
4. Gain practical skills in the processing of plant specimens for herbariums, fostering a comprehensive understanding of herbarium workflow and management.
5. Study and apply methods for the wet preservation of cryptogams and phanerogams, learning how to prepare and maintain specimens in fluid media to retain their morphological characteristics.
6. Explore and demonstrate contemporary preservation techniques, particularly those used in dry floral arrangements, to understand their aesthetic and practical applications in botanical science and decorative arts.
7. Participate in visits to museums, herbariums, or plant preservation processing units to gain first-hand experience of professional environments and current practices in plant preservation.

**OUTCOMES:**

1. Students will be proficient in the use of various tools and equipment for plant preservation, understanding their specific uses and maintenance requirements.
2. Students will demonstrate mastery in several specimen drying techniques and will be able to choose and apply the best method based on the nature of the plant material and the intended use of the specimens.
3. Students will gain skills in preparing and processing pressed specimens for herbarium storage, ensuring the longevity and utility of collected specimens for scientific research.
4. Students will acquire hands-on experience in preserving plant specimens using wet preservation methods, ensuring the preservation of cellular structures and morphological details necessary for further scientific study.
5. Students will learn and demonstrate modern methods used in the preservation of botanical specimens, particularly in creating dry floral arrangements.
6. Through visits to museums, herbariums, and plant preservation units, students will integrate classroom learning with professional practices, understanding the operational standards and challenges in botanical preservation environments.
7. Students will successfully collect, prepare, and document a variety of preserved specimens, including herbarium sheets and wet preserved samples.

**F. Y. B. Sc. Botany [Semester - II]****Course Category – Skill Enhancement Course – Practical (SECP)****Course Code – SEC-151-BOT-P****Course Title: Plant Preservation Techniques****[No. of Credits: 2 C]****[No. of Lectures: 60 L]**

<b>Sr. No.</b>	<b>Title of the Practical</b>	<b>No. of Practical</b>
<b>1</b>	Study of tools and equipment used in plant collection.	<b>1 P</b>
<b>2</b>	Study of preparation of dried specimen using different drying methods - Air drying, Press drying, Desiccant drying, Oven drying and Glycerin drying.	<b>3 P</b>
<b>3</b>	Study of preparation of pressed specimen for herbarium preparation.	<b>1 P</b>
<b>4</b>	Demonstration of Processing of specimen with respect to Identification, Label preparation, Mounting, Accessioning.	<b>1 P</b>
<b>5</b>	Preparation of herbarium sheets of flowering plants.	<b>1 P</b>
<b>6</b>	Study of wet preservation techniques for cryptogams.	<b>2 P</b>
<b>7</b>	Study of wet preservation techniques for phanerogams.	<b>2 P</b>
<b>8</b>	Demonstration of modern preservation methods used in dry floral arrangements.	<b>2 P</b>
<b>9</b>	Visit to museum/herbarium/ plant preservation processing unit.	<b>1 P</b>
<b>10</b>	Submission of Herbarium, dried preserved specimens and wet preserved specimens.	<b>1 P</b>

**F. Y. B. Sc. Botany [Semester - II]**  
**Course Category – Skill Enhancement Course – Practical (SECP)**  
**Course Code – SEC-152-BOT-P**  
**Course Title: Millets for Sustainable Agriculture Development**  
**[No. of Credits: 2 C] [No. of Lectures: 60 L]**

**OBJECTIVES:**

1. Students will identify and classify major and minor food yielding crops, focusing on millets.
2. Students will explore and demonstrate the range of by-products derived from millets.
3. Students will learn about the nutritional values, processing methods, and typical uses of by-products of millets.
4. Students will gain knowledge on various millet-based products, focusing on value addition and sensory analysis.
5. Objected at demonstrating the utilization of different bioprocessing techniques, such as malting and fermentation. cleaning, dehulling, milling
6. Students will be expected to compile detailed reports on their visits and experiments, demonstrating their ability to document processes, results, and insights effectively.

**OUTCOMES:**

1. Students will acquire a comprehensive understanding of different types of millets.
2. Participants will gain detailed knowledge about the by-products of millets, and understand the processing techniques,
3. Through demonstrations and visits to processing units, students will develop hands on skills.
4. The practical will enhance students' knowledge about the cultivation, processing, and uses of millets.
5. Students will be familiar with integrated pest management (IPM) techniques for sustainable millet cultivation.

**F. Y. B. Sc. Botany [Semester - II]****Course Category – Skill Enhancement Course – Practical (SECP)****Course Code – SEC-152-BOT-P****Course Title: Millets for Sustainable Agriculture Development****[No. of Credits: 2 C]****[No. of Lectures: 60 L]**

<b>Sr. No.</b>	<b>Title of the Practical</b>	<b>No. of Practical</b>
<b>1</b>	Analysis of millet grain samples for nutritional content (protein, carbohydrates, vitamins)	<b>2 P</b>
<b>2</b>	Identification and preservation of millet landraces.	<b>1 P</b>
<b>3</b>	Experiment with different bioprocessing techniques, such as malting and fermentation. cleaning, dehulling, milling	<b>1 P</b>
<b>4</b>	Design and create millet-based products, focusing on value addition and sensory analysis.	<b>2 P</b>
<b>5</b>	Develop millet-based food products for animal feed	<b>2 P</b>
<b>6</b>	To study soil parameters for millets	<b>1 P</b>
<b>7</b>	Identification of common pests and diseases affecting millet crops.	<b>2P</b>
<b>8</b>	Application of integrated pest management (IPM) techniques for sustainable millet cultivation	<b>2P</b>
<b>9</b>	Visit a local millet farm to observe different millet varieties and cultivation practices / Visit ICRISAT / Indian Institute of Millet Research / CFTRI	<b>2P</b>

**F. Y. B. Sc. Botany [Semester - II]**  
**Course Category – Skill Enhancement Course – Practical (SECP)**  
**Course Code – SEC-153-BOT-P**  
**Course Title: Plant Propagation Techniques**

**[No. of Credits: 2 C]**

**[No. of Lectures: 60 L]**

**OBJECTIVES:**

1. Enable students to identify and demonstrate the use and maintenance of various tools and equipment essential for plant propagation, ensuring a thorough understanding of their applications in horticulture.
2. Introduce students to the concepts and operational details of various plant propagation units. Utilize ICT tools to demonstrate the various climatic controls and their effects on plant growth, preparing students for modern horticultural practices.
3. Equip students with the knowledge to identify and describe various types of ornamental plants enhancing their understanding of botanical diversity and aesthetic applications.
4. Teach students the practical aspects of nursery management which are crucial skills for nursery operation.
5. Provide practical exposure to natural and artificial vegetative propagation methods to understand the biological and environmental factors that influence successful plant propagation.
6. Demonstrate various nursery management practices including different types of irrigation systems, fertilizer applications, and weed control methods. This will enable students to manage nurseries effectively and sustainably.
7. Introduce students to advanced horticultural practices to provide modern approaches and creative solutions in urban horticulture.

**OUTCOMES:**

1. Students will gain hands-on experience and proficiency in the use and maintenance of various tools and equipment used in plant propagation, enabling effective and efficient handling of nursery operations.
2. Students will be able to operate and manage different types of controlled environments for plant propagation.
3. Students will develop skills in identifying, categorizing, and cultivating different types of ornamental plants for enhancing their ability to design and maintain aesthetic garden spaces.
4. Students will acquire the ability to prepare nursery beds, select appropriate planting materials and containers, and effectively raise seedlings, applying their knowledge to the establishment and management of a successful nursery.
5. Students will master both natural and artificial vegetative propagation methods with diverse methods to propagate various plant species.
6. Students will demonstrate knowledge and practical skills in different types of irrigation systems, fertilizer applications, and weed control strategies, contributing to sustainable nursery and garden management.
7. Students will learn and apply advanced horticultural practices using modern tools and techniques, showcasing their capability in specialized gardening methods.

**F. Y. B. Sc. Botany [Semester - II]****Course Category – Skill Enhancement Course – Practical (SECP)****Course Code – SEC-153-BOT-P****Course Title: Plant Propagation Techniques****[No. of Credits: 2 C]****[No. of Lectures: 60 L]**

<b>Sr. No.</b>	<b>Title of the Practical</b>	<b>No. of Practical</b>
<b>1</b>	Demonstration of Tools and Equipment's used for plant propagation	<b>01 P</b>
<b>2</b>	Demonstration of Glass house, Green House, Net House and Poly house using ICT tools	<b>01 P</b>
<b>3</b>	Study of plants in ornamental gardens – Climbers, Creepers, Palms, Ferns, Grasses (Cacti) and Succulents.	<b>01 P</b>
<b>4</b>	Demonstration of planting materials and various types of containers used in nursery.	<b>01 P</b>
<b>5</b>	Preparation of nursery beds for raising of seedlings.	<b>01 P</b>
<b>6</b>	To study the natural vegetative methods of plant propagation.	<b>02 P</b>
<b>7</b>	To study the artificial vegetative methods of plant propagation – cutting and grafting	<b>02 P</b>
<b>8</b>	To study the artificial vegetative methods of plant propagation – budding and layering	<b>02 P</b>
<b>9</b>	To study the potting and repotting of ornamental plant.	<b>01 P</b>
<b>10</b>	Demonstration of different types of irrigation systems, fertilizer applications and weed practices in nursery management.	<b>01 P</b>
<b>11</b>	Demonstration of Bonsai techniques, Terrace, Vertical, and Indoor Garden with the help of ICT tools.	<b>01 P</b>
<b>12</b>	Visit to crop/Ornamental /Forest nursery and submission of visit report.	<b>01 P</b>



**F.Y. B. Sc. Botany  
Semester – II**

COURSE DETAILS	COURSE CODE	COURSE TITLE	CREDITS
Ability Enhancement Courses (AEC) - (1T = 2 C)	AEC-151-ENG-T	English	2 C
Value Education Courses (VEC) - (1T = 2 C)	VEC-151-ENV-T	Environmental Awareness	2 C
Co-curricular Courses (CC) - (1T = 2 C)	CC-151-T	Any one from basket	2 C