**DR.BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,**

**CHHATRAPATI SAMBHAJINAGAR.**

**NAAC- 'A+' Grade**

**CIRCULAR NO.SS/ Sci & Tech./ B.Voc /13 /2025.**

It is hereby inform to all concerned that, on the recommendation of the Dean, Faculty of Sconce & Technology; **the Academic Council at its meeting held on 21 July, 2025 has been accepted *the "following Curriculum at UG Level* as per National Education Policy-2020" *for the implementation of all concerned affiliated colleges*** under the Faculty of Science & Technology.

| Sr.No | Subject Name | Semester |
|---|---|---|
| 1. | B.Voc in Plant Tissue Culture and Green House Technology (Pattern 2024) | I & II |
| 2. | B.Voc in Renewable Energy Sources (Pattern 2024) | I & II |
| 3. | B.Voc in Architectural Planning & Interior Design | III & IV |
| 4. | IT Skills and Software Development | III & IV |

***This is effective from the Academic Year 2025-26 onwards under the Faculty of Science & Technology.***

All concerned are requested to note the contents of the circular and bring notice to the students, teachers and staff for their information and necessary action.

University campus, 1420-22
Chhatrapati Sambhajinagar-431004.
Ref. No. S S/Sci & Tech/B.Voc./2025-26/
Date: 01/ 08/ 2025

**Deputy Registrar,**
**Syllabus Section**

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**Copy forwarded and Information to necessary action:-**

1] **The Head, concerned Department,**

2] **The Director, Board of Examination & Evaluation,**

3] **The Director,** University Network & Information Centre, UNIC, with a **request to upload this circular on University Website.**
Dr. Babasaheb Ambedkar Marathwada University **Chhatrapati Sambhajinagar.**

**Dr. Babasaheb Ambedkar Marathwada University,**

**Chhatrapati Sambhajinagar – 431001**

Three Year

# B. Voc. Degree Program

Course Structure

(Revised)

(AS PER NEP-2020)

**Subject (Major):**

# Plant Tissue Culture and Green House Technology

(Pattern 2024)

**Effective from 2025-26**

## Preface

The National Education Policy (NEP) 2020 has introduced significant reforms aimed at transforming the education landscape in India. Here's how NEP 2020 intersects with skill education:

1. Multidisciplinary Education: NEP 2020 emphasizes multidisciplinary education, encouraging students to pursue a broad range of subjects and skills. This approach promotes flexibility and enables students to develop diverse skill sets tailored to their interests and career goals.

2. Holistic Development: The policy advocates for holistic development, which includes not only academic learning but also social, emotional, and vocational skills, This holistic approach ensures that students are well-rounded individuals equipped to navigate various aspects of life and work.

3. Vocational Education and Internships: NEP 2020 places a strong emphasis on vocational education, integrating it into mainstream curriculum from an early age. The policy encourages hands-on learning experiences, internships, and apprenticeships to provide practical skills and real- world exposure to students.

4. Focus on Critical Thinking and Problem-Solving: NEP 2020 prioritizes the development of critical thinking, creativity, and problem-solving skills. These skills are essential for innovation and adaptability in a rapidly changing world and are integrated across all levels of education.

5. Flexible Learning Pathways: The policy promotes flexible learning pathways, allowing students to choose their own educational trajectories based on their interests, aptitudes, and aspirations. This flexibility enables students to explore diverse skill areas and tailor their education to suit their individual needs.

6. Teacher Training and Professional Development: NEP 2020 recognizes the importance of teacher training and professional development in enhancing the quality of education. The policy emphasizes continuous learning for teachers, equipping them with the knowledge and skills necessary to effectively nurture students' talents and abilities.

7. Digital Education and Technology Integration: The policy advocates for the integration of digital technology in education to enhance access, equity, and quality. Digital platforms and tools are leveraged to facilitate interactive learning experiences, skill development, and personalized instruction.

By aligning with the principles and objectives of NEP 2020, skill education in India is poised to undergo a transformative shift, fostering innovation, equity, inclusivity, and excellence in education. These contexts have remained as mainframe while developing this curriculum.

The University has adapted Outcome-based education (OBE) since 2017. OBE is widely adopted in educational systems globally due to student centric advantages. OBE provides clear and measurable learning objectives that help students focus and stay motivated. It emphasizes real- world skills, bridging the gap between academia and the workforce. Customized learning paths are possible, accommodating different learning styles and promoting inclusivity. OBE focuses on mastery and competency rather than seat time, encouraging deeper learning and retention of knowledge. Continuous improvement is encouraged through ongoing assessment and feedback. OBE promotes accountability and transparency, allowing stakeholders to monitor progress and evaluate educational programs. It equips students with skills needed for the globalized economy, fostering critical thinking and collaboration. Lifelong learning skills like self-directed learning and adaptability are developed, creating a culture of continuous

improvement. Overall, OBE offers a holistic approach to education, emphasizing relevant skills, competencies, and attitudes crucial for success in today's ever-changing world.

The authorities of Dr. Babasaheb Ambedkar Marathwada University, CHHATRAPATI SAMBHAJINAGAR (M.S.), remaining aligned to accreditation standards of National Assessment and Accreditation Council, decided to opt for National Education and Policy and Outcomes Based Education (OBE). As the part of the decision, different meetings, workshops and presentations were held at the campus of university.

This document is the outcome such meetings and workshops held at University level and department level. The detailed document is designed and the existing curriculum of the department has been meticulously analysed from the standpoint of the immediate and long-time requirements of manufacturing and process industries, and transformed in to the framework of NEP with OBE. This is the first step towards the implementation of NEP with OBE in the university departments and affiliated colleges. The document will serve all stakeholders in the effective implementation of the curriculum. The OBE is continuous process for quality enhancement and it will go a long way in order to enhance the competencies and employability of the Graduates/Post-graduates of the university departments and affiliated colleges.

As we stand on the threshold of a new era in education, the dawn of the National Education Policy 2020 illuminates our path toward a holistic, inclusive, and progressive educational landscape. The Bachelor of Vocation (B. VOC.) curriculum outlined herein reflects the ethos and aspirations of this transformative policy, aiming to equip learners with the knowledge, skills, and values necessary to thrive in the dynamic world of the 21st century. At its core, the National Education Policy 2020 envisions an educational framework that is learner-centric, multidisciplinary, and geared towards fostering creativity, critical thinking, and innovation. It emphasizes the integration of knowledge across disciplines, breaking down traditional silos to encourage holistic understanding and application of concepts. The Bachelor of Vocation (B. VOC.) curriculum embodies these principles by offering a diverse array of courses spanning various scientific domains, while also incorporating interdisciplinary studies to nurture well-rounded graduates capable of addressing complex challenges with agility and insight. Furthermore, the curriculum is designed to promote experiential learning, research, and hands- on exploration, recognizing the importance of Lab Course engagement in deepening understanding and cultivating real-world skills. Through laboratory work, field experiences, internships, and project-based learning opportunities, students will have the chance to apply theoretical knowledge in Lab Course settings, develop problem-solving abilities, and cultivate a spirit of inquiry and discovery. Integral to the National Education Policy 2020 is the commitment to inclusivity, equity, and access to quality education for all. The Bachelor of Vocation (B.Voc.) curriculum reflects this commitment by embracing diversity in perspectives, backgrounds, and experiences, and by fostering an inclusive learning environment where every student feels valued, supported, and empowered to succeed.

Moreover, the curriculum emphasizes the cultivation of ethical values, social responsibility, and global citizenship, instilling in students a sense of accountability towards society and the environment. By integrating courses on ethics, sustainability, and social sciences, the Bachelor of Vocation (B. Voc.) program aims to produce graduates who are not only proficient in their respective fields but also compassionate, ethical leaders committed to making a positive impact on the world. As we embark on this journey of educational transformation guided by the National Education Policy 2020, the Bachelor of Vocation (B. Voc.) curriculum stands as a testament to our collective vision of a more equitable, inclusive, and enlightened society. It is our hope that through rigorous academics, innovative pedagogy, and unwavering dedication to excellence, we can inspire the next generation of scientists, scholars, and

change-makers to realize their full potential and contribute meaningfully to the advancement of knowledge and the betterment of humanity.

In light of aforesaid, Dr. Babasaheb Ambedkar Marathwada University hereby proposes to offer a three years Bachelor of Vocation program (B. Voc.) in Plant Tissue Culture and Green House Technology. The curriculum design of this program is undertaken with following considerations

It emphasis on the integration of modern agricultural practices within the educational framework to empower students with cutting-edge knowledge and skills. In this context, the course on Plant Tissue Culture and Greenhouse Technology is designed to equip students with theoretical and practical insights into these advanced horticultural techniques.

Plant tissue culture is a vital technique in modern biotechnology, enabling the mass production of genetically uniform and disease-free plants. This course will cover the basics of tissue culture, including sterilization, media preparation, inoculation, and regeneration of plants. By understanding the principles and applications of tissue culture, students will be prepared to contribute to plant conservation, genetic improvement, and sustainable agriculture.

Greenhouse technology, on the other hand, offers a controlled environment for the cultivation of plants, ensuring optimal growth conditions irrespective of external weather fluctuations. The course will introduce students to the design, construction, and management of greenhouses, including climate control, irrigation systems, and pest management. Mastery of these techniques will empower students to maximize crop yield, quality, and resource efficiency.

Overall, this course aims to inspire innovation and entrepreneurship in the agricultural sector, fostering a generation of skilled professionals who can drive sustainable development and food security. We hope that this curriculum will ignite a passion for plant science and technology among students, encouraging them to explore and advance the frontiers of modern agriculture.

The course on Plant Tissue Culture and Greenhouse Technology is designed to inspire innovation and entrepreneurship in the agricultural sector. By providing students with cutting-edge knowledge and practical skills, we aim to foster a generation of skilled professionals who can drive sustainable development and food security. This curriculum aligns with the goals of the National Education Policy 2020, promoting an educational experience that is both forward-thinking and deeply rooted in the principles of sustainable agriculture.

## Programme Educational Objectives (PEOs) :

Programme Educational Objectives (PEOs) for the Bachelor of Vocation Curriculum under

the National Education Policy 2020:

• **Develop Core Competency**: Graduates will have comprehensive knowledge and practical skills in plant tissue culture and greenhouse technology, enabling them to excel in agricultural and biotechnological sectors.

• **Enhance Employability and Entrepreneurship**: Prepare graduates for diverse roles in agriculture, biotechnology, horticulture, and commercial plant production, fostering an entrepreneurial mindset for self-employment opportunities.

• **Strengthen Practical and Research Skills**: Provide hands-on training in tissue culture techniques, plant propagation, and greenhouse management, encouraging research and innovation in sustainable agriculture practices.

• **Promote Sustainable Agricultural Practices**: Instil principles of sustainable and smart agriculture, emphasizing controlled environment farming, hydroponics, and the integration of biotechnological advancements to enhance crop productivity.

• **Cultivate Critical Thinking and Innovation**: Encourage analytical thinking and problem-solving skills, enabling students to develop innovative solutions addressing challenges in plant science and agriculture.

• **Integrate Digital and Technological Proficiency**: Familiarize students with digital tools, automation, and precision agriculture technologies, enhancing efficiency in plant cultivation and greenhouse operations.

• **Encourage Lifelong Learning and Advanced Studies**: Motivate students to pursue continuous learning, higher education, and research opportunities in plant sciences and related disciplines.

• **Instil Ethical and Social Responsibility**: Foster a commitment to ethical practices, environmental stewardship, and social responsibility in all agricultural and biotechnological endeavours.

**Program Outcomes (PO):**

**Vocational Education** is education that prepares the students for specific trades, crafts andcareers at various levels and scopes. Scope of modern fabric of vocational education builds Human resource from a trade/ craftsmanship, technician or professional position in R & D organizations.

**The Program Outcomes are the skills and knowledge which the students have at each exit level/at the time of graduation. These Outcomes are generic and are common to all exit levels mentioned in the programme structure. Graduates of the B.Voc program are expected to -**

**PO1.** Apply broad based fundamental knowledge of the specific skill-based trade for the solution of target skill sector.

**PO2.** Identify industry domain related problems at varied complexity and analyze the same to formulate/ develop substantiated conclusion using first principles of domain sectors and technical literature.

**PO3.** Design / develop solutions for broad based problems in the target skill-based trade to address changing challenges put forward by market demand/ stakeholder

**PO4.** Design and conduct technology enabled experiments, analyze the resulting data and interpret the same to provide valid conclusions

**PO5.** Use the techniques, skills and modern tools necessary skill-based trade to practice with clear understanding of limitations.

**PO6.** Apply broad understanding of ethical and professional skill-based trade practice in the context of global, economic, environmental and societal realities while encompassing relevant contemporary issues.

**PO7.** Apply broad understanding of impact of skill-based trade in a global, economic, environmental and societal context.

**PO8.** Apply ability to develop practical solutions for skill trade problems within positive professional and ethical boundaries.

**PO9.** Function effectively as a leader and as well as team member in diverse/multidisciplinary environments.

**PO10.** Communicate effectively in oral and written format addressing specific professional/social demands.

**PO11.** Demonstrate knowledge and understanding of the first principles of skill trade and apply these to one's own work as a member and leader in a team, to complete project in any environment.

**PO12.** Recognize the need for and have the ability to acquire advance knowledge for addressing the changing technological demands of the target skill trade.

**Program Specific Outcomes (PSO):**

**Graduates of the B.Voc (Plant Tissue culture and Green House technology) program are expected to -**

1. **Proficiency in Plant Tissue Culture:** Master and apply techniques such as aseptic practices, media preparation, explant selection, callus induction, and micropropagation for the production of high-quality, disease-free plants.

2. **Expertise in Greenhouse Management:** Design, construct, and manage greenhouse structures and controlled environments to optimize plant growth and productivity.

3. **Application of Controlled Environment Agriculture:** Utilize modern environmental control systems for heating, cooling, ventilation, and lighting to create optimal growing conditions in greenhouses.

4. **Sustainable and Integrated Agricultural Practices:** Implement sustainable practices by integrating soil and water management, nutrient management, and eco-friendly cultivation techniques within tissue culture and greenhouse operations.

5. **Problem-Solving and Innovation:** Analyze challenges in plant propagation and controlled environment farming, and develop innovative solutions to improve crop yield, quality, and sustainability.

**Eligibility:**

10+2 / MCVC/ ITI (two years) with relevant/equivalent trade from any recognized Board/Institution are eligible for registration/ admission to first year (Semester I) of B.Voc Industrial Automation Degree program.

**Exit Options:**

The programme allows exit of a student in an intermediate stage, on successful employment. Scopes will be there for further continuation of study. The other wise exit options will be as follows-

| *Exit Point* | *Duration* | *Diploma / Degree to be Offered* |
|---|---|---|
| First exit | After 1 yr. | Certificate in Vocation |
| Second exit | After 2 yrs. | Diploma in Vocation |
| Third exit | After 3 yrs. | Bachelor in Vocation (B. Voc.) |

3 years degree Course in
Plant Tissue Culture and Green House Technology
SYLLABUS
Scheme of the Program

**PTCGHT BVOC SEM-I**

| Course Type | Course code | Course Name | Contact Hours per week | | Credit assigned | | Total Credit | Total contact hours for the course |
|---|---|---|---|---|---|---|---|---|
| | | | Th. | Pr. | Th. | Pr. | | |
| Major (core)M1 Mandatory | PTCGHT/DSC/T/100 | Fundamentals of Cell | 2 | 0 | 2 | - | 2+2=4 | 30 |
| | PTCGHT/DSC/P/126 | Practical based on PTCGHT/DSC/T/100 | 0 | 4 | - | 2 | | 60 |
| Major (core)M2 Mandatory | PTCGHT /DSC/T/101 | Introduction to Plant Tissue culture | 2 | 0 | 2 | - | 2+2=4 | 30 |
| | PTCGHT /DSC/P/127 | Lab course based on PTCGHT /DSC/T/101 | 0 | 4 | - | 2 | | 60 |
| Major (core)M3 Mandatory | PTCGHT / DSC/T/102 | Culture techniques | 2 | 0 | 2 | - | 2+2=4 | 30 |
| | PTCGHT /DSC/P/128 | Lab course based on PTCGHT / DSC/T/102 | 0 | 4 | - | 2 | | 60 |
| Generic open elective (choose any one pool of courses) other than Major | PTCGHT /GE/OE/T/100 | Basics of Horticulture | 2 | 0 | 2 | - | 2 | 30 |
| SEC (Choose any one pool of courses) | PTCGHT /SEC/PTC 107 | Nursery Plants Cultivation | 1 | 0 | 1 | - | 1+1=2 | 15 |
| | PTCGHT/SEC/P/126 | Lab course based on PTCGHT/SEC/PTC 107 | 0 | 2 | - | 1 | | 30 |
| | PTCGHT/SEC/T/101 | Basic Gardening Skills | 1 | 0 | 1 | - | 1+1=2 | 15 |
| | PTCGHT/SEC/P/127 | Lab course based on PTCGHT/SEC/T/101 | 0 | 2 | - | 1 | | 30 |
| AEC, VEC, IKS | PTCGHT /IKS/T/101 | English (Common for all the faculty) | 2 | - | 2 | - | 2+2=4 | |
| | PTCGHT/IKS | (Choose any one pool of courses) | 2 | - | 2 | - | | |
| OJT/FP/CEP/CC /RP | PTCGHT/CC/P/126 | Health and wellness | - | 4 | - | 2 | 2 | |
| Total | | | 13 | 18 | 13 | 09 | 22 | |

## PTCGHT/DSC/T/100 Fundamentals of Cell

**Marks:-50** **Total Contact Hours:-30**

**Learning Objectives of the Course:** To provide students with-

1. Comprehend Cell Architecture and Origins: Differentiate between eukaryotic and prokaryotic cells, and Identify the unique features of a typical plant cell.

2. Understand Cellular Organelles, Analyze Cell Structural Components, Master Cell Signaling Mechanisms and Grasp the Principles of Cell Differentiation.

**Course Outcomes ( COs) :**
On completion of the course, students should be able to -

1. Recall and explain the fundamental concepts of cell architecture—including the discovery of cells, differences between eukaryotic and prokaryotic cells, the endosymbiotic theory, and the structural features of a typical plant cell.

2. Identify and describe the ultrastructure and functions of major cellular organelles (plasma membrane, Golgi complex, endoplasmic reticulum, vacuoles, lysosomes, chloroplasts, and mitochondria) and apply this knowledge to interpret their roles in cellular processes.

3. Analyze the organization of cell structures by evaluating the functional aspects of the nuclear envelope, cytoskeletal elements, and chromosomal arrangement, and explain how these components contribute to overall cell function.

**Unit I- (Cell Architecture and origin)** Discovery of Cell, Structure of Eukaryotic and Prokaryotic cell, Endosymbiotic origin of Eukaryotic cell, Structure of typical plant cell.

**Unit II- Cellular Organelles)** Ultra-structure and functions of Plasma Membrane, Golgi Complex, Endoplasmic Reticulum, Vacuoles, Lysosomes, Chloroplast, Mitochondria.

**Unit III- Cell Structures** Ultra-structure and functional aspects of Nuclear Envelope, Cytoskeletal structures, Chromosomal organization.

**Unit IV- Cell Signaling)** Cell-Cell Interaction, G-protein coupled reactions, Secondary Messengers, Growth factors in cell signaling, Na-K Atpase pump.

**Unit V- (Cell Differentiation)** Phenomenon of Cell Differentiation, Totipotency, Factors affecting cellular Differentiation, Experimental basis of cell differentiation.

**References**

Loewy, A. and Siekevitz, P. (1963). Cell Structure and Function. Holt, Reinhart and Winston, New York.
The Cell – A Molecular Approach, Cooper & Hausman, ASM Press, 2004.
Cell and molecular biology, EDPDe Robertis, EMF De Robertis, Lea &. Febiger Intl. ed.1991.
Molecular Biology of the Cell, B. Alberts, et al., Garland Science, 4th ed. 2002.
Molecular Cell Biology Hardcover ,James E. Darnell, Harvey Lodish, David Baltimore,1999

**Paper:- PTCGHT/DSC/P/126 Practical's Based on Cell PTCGHT/DSC/T/100**

**Marks:-50** **Total contact Hours:-60**

**Learning Objectives of the Course:** To provide students with-

1. Understand the key components and functions of the microscope to enable accurate and effective observation of cellular structures.
2. Develop the skill to identify and distinguish between different stages of mitosis and meiosis by observing prepared slides.
3. Calculate the mitotic index from cell samples to quantitatively assess the rate of cell division and interpret its biological significance.

**Course Outcomes ( COs) :**

On completion of the course, students should be able to -

**1:** Recall and describe the basic parts and functions of a microscope, explaining how each component contributes to effective cellular observation.

**2:** Operate a microscope to view prepared slides, and accurately identify and describe the different stages of mitosis in various cell samples.

**3:** Examine plant material (e.g., onion buds) under the microscope to differentiate between stages of meiosis, analyzing cellular morphology and changes during each phase.

**4:** Calculate and interpret the mitotic index from a given sample, critically assessing the quality of cell division data and the effectiveness of the sample preparation.

List of Experiments

1. Introduction to Microscope.
2. Identification of different stages of mitosis.
3. Identification of different stages of meiosis from suitable plant material (Onion Buds)
4. Study of mitotic index from suitable plant material.
5. Techniques of preparation of permanent and semi-permanent slides.

**PTCGHT /DSC/T/101 Introduction to Plant Tissue culture**

**Marks:-50** **Total Contact Hours (30 Periods)**

**Learning Objectives of the Course:** To provide students with-

1. Define fundamental terms, concepts, and the historical background of plant tissue culture.
2. Recognize the organization of a tissue culture laboratory, including essential tools, techniques, and methods of sterilization.
3. Apply methods of micropropagation using various explants to regenerate plants.

**Course Outcomes ( COs) :**

On completion of the course, students should be able to -

**1:** Demonstrate an in-depth understanding of the basic principles, historical background, terminology, and laboratory organization essential to plant tissue culture.

**2:** Effectively initiate and maintain plant tissue cultures by applying techniques such as callus induction, cell suspension culture, and micropropagation using various explants

**3:** Critically analyse and optimize advanced plant regeneration strategies, including organogenesis and somatic embryogenesis and propose methods for developing haploids and doubled haploids.

**Unit I: (Introduction to Plant tissue culture)** Introduction to Plant Tissue culture, Terms and definitions, Historical background,

**Unit II: (Laboratory methods)** Laboratory organization, Tools and techniques, methods of sterilization. Laboratory contaminants- it's control and measures.

**Unit III: (Initiation of Culture)** Induction and growth parameters; Culture initiation, Callus and cell suspension culture techniques

**Unit IV**: **Micropropagation** through various explants (Leaf, Stem, Axillary bud, Tuber, Corms and Bulbills).

**Unit V**: **Organogensisis and somatic embryogenesis**, Anther and ovary culture, microspore culture, Meristem culture etc., development of haploids and doubled haploids.

**Reference Books:-**

S. S. Bhojwani and M. K. Razdan (1996). Plant Tissue Culture: Theory and Practice. Elsevier. This book provides comprehensive information on theoretical, practical, and applied aspects of plant tissue culture.

Lydiane Kyte, John Kleyn, and Holly Scoggins (2000). Plants from Test Tubes: An Introduction to Micropropagation. Academic Press. This book offers clear images and illustrations related to different tissue culture concepts, work processes, and equipment.

Gamburg, O. L., & Philips, G. C. (2000). Plant Cell, Tissue and Organ Culture: Fundamental Methods. Springer. This book is designed for professionals and advanced students, offering comprehensive guidance on both fundamental and applied plant cell and molecular technologies.

Hans-Walter Heldt (2011). Plant Biochemistry. Academic Press. This book covers the fundamental principles of plant biology and the practical applications of plant biochemistry in various industries.

V. Kumaresan (2010). Applied Plant Biotechnology. This book provides insights into the application of biotechnology in plant science..

R. H. Smith (2012). Plant Tissue Culture: Techniques and Experiments. Academic Press. This book provides a practical guide to the techniques used in plant tissue culture.

K. Lindsey and M. G. K. Jones (1989). Plant Tissue Culture Manual. Kluwer Academic Publishers. This manual offers detailed protocols and methodologies for plant tissue culture.

T. A. Thorpe (2007). Plant Cell Culture: Essential Methods. Wiley-Blackwell. This book provides essential methods and protocols for plant cell culture.

R. N. S. Gautham (2015). Plant Tissue Culture and Biotechnology: Emerging Trends. CBS Publishers. This book explores the latest trends and techniques in plant tissue culture and biotechnology.

T. J. Fu and G. Singh (1999). Plant Tissue Culture and Transformation. CRC Press. This book covers various aspects of plant tissue culture and genetic transformation.

**Online Reference:**

1. **https://nptel.ac.in/courses/102106080**

**PTCGHT /DSC/P/127 Introduction to Plant Tissue culture**

Marks:- 50 Total contact Hours:-60

**Learning Objectives of the Course:** To provide students with-
1. Recognize the various types of organ culture techniques used in plant tissue culture and Explain the applications and advantages of each type in plant regeneration.

2. Learn the detailed protocol for initiating callus culture, including media preparation, explant selection, and sterilization procedures and establish and maintain callus cultures under controlled laboratory conditions.

**Course Outcomes ( COs) :**
On completion of the course, students should be able to -

**1:** Understand the various types of organ cultures and the underlying principles of tissue culture and differentiate between callus culture, cell suspension culture, and other organ culture methods.

**2:** Successfully execute protocols for callus culture and establish cell suspension cultures under aseptic conditions and apply standard laboratory techniques to initiate and sustain cultures with reproducible results.

**3:** Investigate the protocols to study cytodifferentiation, assessing morphological changes and cellular behavior.

**List of Experiments**

1. Types of organ culture
2. Protocol of Callus culture
3. Establishment of callus culture.
4. Protocol for cell suspension culture
5 Protocol to study cyto differentiation

## PTCGHT / DSC/T/102 Culture techniques

**Marks:-50** **Total Contact Hours (30 Periods)**

**Learning Objectives of the Course:** To provide students with-
1. Identify suitable explants for tissue culture based on plant type and intended outcome and Learn proper sterilization techniques to eliminate contaminants and perform aseptic inoculation of explants.

2. Explain the importance and underlying principles of organ culture in plant tissue regeneration and describe the principles behind callus induction and the formation of callus tissue.

3. Explain the fundamental concepts and protocols involved in establishing cell suspension cultures.

**Course Outcomes ( COs) :**
On completion of the course, students should be able to -

**1:** Develop expertise in explant selection, sterilization, inoculation, and media preparation using formulations such as MS, B5, SH, PC, and L-2.

**2:** Apply protocols for organ culture (including shoot tip/meristem, flower bud, ovary, and ovule culture) and callus induction, while understanding their significance in plant regeneration.

**3:** Set up cell suspension cultures, monitor growth patterns, perform viability tests, and evaluate the overall importance of suspension cultures in tissue culture applications.

**Unit 1: Explants** selection, sterilization and inoculation; Various media preparations; MS, B5, SH PC L-2.

**Unit 2: Organ culture**, Principle, protocol, importance of organ culture, Shoot tip or meristem culture, Mericloning, Flower bud or Complete flower culture, Ovary culture and its importance, Ovule culture.

**Unit 3: Callus culture**, principle, protocol,, callus tissue formation, structure and characteristics of callus culture and its significance.

**Unit 4: Cell suspension culture**- Principle protocol, general account, growth pattern in suspension culture, test for viability of cell, Importance of cell suspension cuture.

**Reference Books:-**
1. Plant tissue culture by M. K. Razdan.
2. Plant tissue culture by Kalyan Kumar De.

**PTCGHT /DSC/P/128 Practical's Based on Culture techniques**

Marks: -50 Total contact Hours: -60

**Learning Objectives of the Course:** To provide students with-

1. Develop practical competence in advanced plant tissue culture techniques by mastering protocols for organogenesis, induction of somatic embryogenesis, embryo culture and understanding the various types of embryo cultures.

2. Understand and evaluate the critical role of plant hormones in tissue culture processes, including their influence on embryogenic induction, organ formation, and the development of artificial seeds.

**Course Outcomes ( COs) :**

On completion of the course, students should be able to -

**1:** Execute protocols for organogenesis and the induction of somatic embryogenesis, showcasing the ability to initiate and manage in vitro plant regeneration.

**2:** Design and apply methods for artificial seed production and various embryo culture techniques, ensuring successful establishment of plant regeneration systems.

**3:** Analyse and optimize the use of plant hormones to regulate tissue culture responses, thereby enhancing the efficiency of organogenesis and embryogenesis processes.

**List of Experiments**

1. Protocol for organogenesis
2. Induction of somatic embryogenesis in culture
3. Methods in making artificial seeds
4. Types of embryo culture and protocol.

5 Importance of hormones in culture

**This course will be available for the students from other faculty**

| PTCGHT /GE/OE/T/100: Basics of Horticulture | | |
|---|---|---|
| **Total Credits : 2**<br>**Total Contact Hours : 30 Hrs** | | **Maximum Marks : 50** |
| **Learning Objectives of the Course:** To make the students aware of the importance of horticulture and impart knowledge about the important gardens in the world and the types of gardens. | | |
| **Course Outcomes ( COs) :**<br>**On completion of the course, students should be able to-**<br>1. Remember the scope, importance and branches of horticulture as well as the types of gardens.<br>2. Understand about the cultural practices for management of insect pests of garden plants<br>3. Apply the knowledge of various plant propagation practices that can be used in day-to-day life | | |
| **Module No.** | **Course Content** | **Contact Hours** |
| I | **Introductory Concepts**<br>1. Concept, scope and importance of horticulture – as an art, science and business: branches of horticulture; classification of horticultural plants.<br>2. Famous gardens in the world and in India: types of gardens based on country of origin, Basic styles of gardens: formal, informal and wild gardens.<br>3. Botanical and ornamental gardens: butterfly garden, herbal garden, kitchen garden, rock garden, roof garden, sensory garden, vertical garden, water garden, container garden. | **10 Hrs** |
| II | **Developing the landscape**<br>1. Developing the landscape: Plan (general), components and features of landscaping – plant components (lawn, shrubbery, flower beds and borders, rockery, carpet beds, topiary, hedges; non plant components (garden adornments, arches, pergolas, trellises, garden walls, gates, garden fences, footpaths, seats, tables, and garden houses).<br>2. Plant growing structures – Shade house, green house, poly house, glasshouse, mist chamber /mist beds, hot beds, lath houses.<br>3. Pre-planting, planting and post-planting cultural practices; Cultural practices to increase productivity: thinning, training, trimming and pruning; Plant propagation practices - Seed propagation and vegetative propagation - natural and artificial. Artificial methods of vegetative propagation: cuttage, layerage, graftage, budding, micropropagation | **10 Hrs** |
| III | **Essential garden tools and implements**<br>1. Essential garden tools and implements - Hand trowel, hoe, spade, fork, shovel, rake; different types of cutting tools – shears: long-handled, short-handled, lawn shears, secateurs, sickles, saw, wheel barrow, watering cans, lawn mower (electric and petrol mower), grass cutters, sprayers and procedure<br>2. Fertilizers - Organic fertilizers: biofertilizers, compost, vermicompost, agricultural waste, livestock manure, municipal sludge; inorganic fertilizers: NPK fertilisers; natural and synthetic soil conditioners and soil ameliorants.<br>3. Common diseases and pests of garden plants, symptoms and causative agents; integrated pest management, physical and biological control, push-pull technology | **10 Hrs** |

**Reference Books:**


- Acquaah, G. 2015. Horticulture Principles and Practices, Pearson Education, Noida.
- Adams, C., Early, M., Brook, J. & Bamford K. 2015. Principles of Horticulture, Taylor & Francis Ltd, UK.
- Chadha, K. L. 2019. Handbook of Horticulture, Indian Council of Agricultural Research, New Delhi.
- Dixon, G. R. & Aldous, D. E. 2014. Horticulture: Plants For People And Places, Springer.
- Kathy F. 2015. Manual of Interior Plantscaping, Timber Press, Portland, Oregon.


**Online Reference:**

https://au.f-interviews.com/6304-horticulture-mooc.html
https://www.swayamprabha.gov.in/index.php/program/archive_he/18
https://nptel.ac.in/courses/126105014
https://nptel.ac.in/courses/126105009
http://www.hillagric.ac.in/edu/coa/horticulture/lecture/Hort-351-Lectures/Hort-351-Lecture-1&2.pdf
http://ecoursesonline.iasri.res.in/course/view.php?id=164

## PTCGHT /SEC/PTC 107 Nursery Plants Cultivation

**Marks:-25** **Total Contact Hours:-15**

**Learning Objectives of the Course:** To provide students with-

1. Develop comprehensive knowledge of nursery plant varieties, propagation techniques, nursery equipment, and operational practices—including plant identification, irrigation methods, fertilizer application, and effective marketing strategies—to ensure efficient nursery management.

2. Acquire practical skills in planning, designing, and constructing nursery infrastructure, such as glass houses, poly houses, net houses, and low-cost greenhouses, with an emphasis on integrating modern technologies (e.g., automation, microcontrollers, and waste water recycling) for sustainable and efficient operations

**Course Outcomes ( COs) :**

On completion of the course, students should be able to -

1: Identify and classify various types of nursery plants (annuals, biennials, perennials, ornamentals, etc.) and demonstrate effective propagation techniques to ensure healthy nursery stock.

2: Develop comprehensive skills in planning and constructing nursery setups—including glass houses, poly houses, net houses, and low-cost greenhouses— by applying principles of site selection, structural design, and proper glazing techniques.

3: Employ modern irrigation systems, advanced fertilizer application methods, and automated technologies (e.g., microcontrollers, waste water recycling) to enhance nursery productivity and ensure sustainable operational practices.

**Unit I**: Nursery Plants: Types of Nursery Plants, Annuals, Biennials, Perennials, Herbaceous, Woody perennials and bulbous plants.

**Unit II**: Identification, classification and growth habits of ornamental trees, shrubs and Climbers used for their ornamental value and as vegetables and fruits.

**Unit III:** Nursery equipments: Equipments and tools in nursery operations, Methods of Propagation of nursery plants, Potting, repotting.

**Unit IV:** Nursery irrigation system, Methods of application of fertilizers Harvesting, Packing, Storage and Marketing of Nursery Stock.

**Unit V:** Planning and Designing, Site selection, Structures and Glazing Planning and Designing: Introduction, Basics of nursery design ; construction, covering material

**Unit VI:** Construction of typical glass house/poly house/ net house, construction of pipe framed greenhouse, Construction of floors and Layout, Design and development of low cost green house structures. Automated greenhouses, microcontrollers, waste water recycling.

**Reference Books: -**

1) Nursery Management" by John Mason.
2) Plant Nursery Management: How to Start and Operate a Plant Nursery by P K Ray.
3) Nursery Management by CSIRO Publishing.
4) Nursery Management – NCERT.

**PTCGHT/SEC/P/126 Practical's Based on PTCGHT /SEC/PTC 10730 (Periods)**

**Learning Objectives of the Course:** To provide students with-

1. Develop the ability to identify and classify a wide range of commercially important greenhouse plants and ornamental species, while also understanding the essential nursery equipment and tools required for effective plant management.

2. To acquire comprehensive knowledge of greenhouse structures —including the study of different types, components, materials, fabrication, erection, and construction details—and apply this understanding to design various types of greenhouses.

**Course Outcomes ( COs) :**
On completion of the course, students should be able to -

1: Accurately recognize and categorize a diverse range of commercially important greenhouse plants—including herbs, shrubs, climbers, epiphytes, aquatic plants, succulents, cacti, ornamentals, house plants, vegetables, and fruits—as well as different types of ornamental plants.

2: Assess and choose appropriate tools and equipment for nursery operations and greenhouse management, and understand the fabrication, erection, and construction details of various greenhouse components and covering materials.

3: Integrate knowledge of different greenhouse types, core materials, and design principles to develop and propose efficient and sustainable greenhouse designs tailored for diverse agricultural applications.

**List of Experiments**

1. Identification of commercially important green house plants (minimum 5 of each) Herbs, Shrubs, Climbers, Epiphytes, Aquatic plants, Succulents, Cacti, ornamentals, house plants, vegetables and fruits.
2. Different types of Ornamental plants.
3. Equipments and tools in nursery
4. Study of different types of greenhouses
5. Study of components of greenhouse, their fabrication, erection and construction details.
6. Study of greenhouse core material and covering material
7. Design different types of green house.

## PTCGHT/SEC/T/101 Basic Gardening Skills

**Learning Objectives of the Course:** To provide students with-
1.To impart knowledge about gardening techniques and practices.

2. To develop essential skills for growing plants and maintaining a garden.

3. To foster an appreciation for sustainable gardening and its environmental benefits.

**Course Outcomes ( COs) :**
On completion of the course, students should be able to

Acquire practical skills in gardening, from soil preparation to pest management

Learn sustainable and eco-friendly gardening practices.

Be equipped to create and maintain their own gardens.

**Marks:-25** **Total Contact Hours:-15**

**Unit 1: Introduction to Gardening**
Importance of gardening: Environmental, aesthetic, and therapeutic benefits
Types of gardens: Residential, kitchen, terrace, and vertical gardens
Basic tools and equipment used in gardening

**Unit 2: Soil and Fertilizers**
Characteristics of different soil types and their preparation
Organic and inorganic fertilizers: Application techniques and benefits
Composting methods and practices

**Unit 3: Planting and Maintenance**
Selecting plants: Annuals, perennials, shrubs, and trees
Planting techniques: Seed sowing, transplanting, and spacing
Maintenance practices: Watering, weeding, pruning, and pest control

**Unit 4: Sustainable Gardening Practices**
Water conservation techniques: Drip irrigation and rainwater harvesting
Recycling and upcycling for garden use
Growing native plants and preserving biodiversity

**Reference Books: -**
1) Basic Horticulture by Jitendra Singh
2) Fundamentals of Horticulture (ICAR eCourse)
3) Rodale's Basic Organic Gardening - A beginner's guide to organic gardening.
4) The Vegetable Gardener's Bible by Edward C. Smith.

**PTCGHT/SEC/P/127 Practical's Based on PTCGHT/SEC/T/101** **30 (Periods)**

| |
|---|
| **Learning Objectives of the Course:** To provide students with- |
| 1. To Develop basic gardening skills, including soil preparation and planting techniques. |
| 2. To Learn to identify and control common garden pests and diseases. |
| **Course Outcomes (COs):** On completion of the course, students should be able to - |
| 1: Students will be able to design and maintain a small-scale garden, such as a kitchen or terrace garden. |
| 2: They will demonstrate the ability to compost organic waste and conserve resources. |
| 3: They will apply gardening techniques to grow a variety of plants sustainably. |

**List of Experiments**

1. Demonstration of basic gardening tools and their use.
2. Preparation of soil beds and planting seeds.
3. Making organic compost using kitchen waste.
4. Identifying and controlling common garden pests.
5. Designing a simple home or terrace garden.

## PTC BVOC SEM-II

| Course Type | Course code | Course Name | Contact Hours per week | | Credit assigned | | Total Credit | Total contact hours for the course |
|---|---|---|---|---|---|---|---|---|
| | | | Th. | Pr. | Th. | Pr. | | |
| Major (core)M1 Mandatory | **PTCGHT/SEC/T /150** | Plant Protoplast Culture | 2 | 0 | 2 | - | 2+2=4 | 30 |
| | **PTCGHT/DSC/ P/176** | Lab course based on **PTCGHT/SEC/T/150** | 0 | 4 | - | 2 | | 60 |
| Major (core)M2 Mandatory | **PTCGHT/SEC/T /151** | Hardening of Plants | 2 | 0 | 2 | - | 2+2=4 | 30 |
| | **PTCGHT/SEC/P /177** | Lab course based on **PTCGHT/SEC/T/151** | 0 | 4 | - | 2 | | 60 |
| Major (core)M3 Mandatory | **PTCGHT/SEC/T /152** | Basics of Controlled Environment Plantation | 2 | 0 | 2 | - | 2+2=4 | 30 |
| | **PTCGHT/SEC/P /178** | Lab course based on **PTCGHT/SEC/T/152** | 0 | 4 | - | 2 | | 60 |
| Generic open elective (choose any one pool of courses) other than Major | **PTCGHT** /GE/T/150 | Vegetative Propagation and Grafting | 2 | 0 | 2 | - | 2 | 30 |
| VSC vocational skill course (choose any one pool of courses) | **PTCGHT /** VSC/T/150 | Soil Cultivation techniques | 1 | 0 | 1 | - | 1+1=2 | 15 |
| | **PTCGHT /** VSC/P/176 | Lab course based on **PTCGHT /** VSC/T/150 | 0 | 2 | - | 1 | | 30 |
| | **PTCGHT /** VSC/T/151 | Phytoremediation | 1 | 0 | 1 | - | 1+1=2 | 15 |
| | **PTCGHT /** VSC/P/177 | Lab course based on **PTCGHT /** VSC/T/151 | 0 | 2 | - | 1 | | 30 |
| AEC, VEC, IKS | **PTCGHT** /AEC/T/151 | Modern Indian Language (MIL-I) (Choose any one from pool of language Courses) | 2 | - | 2 | - | 2+2=4 | |
| | **PTCGHT** /IKS-1 | Constitution of India (choose any one pool of courses) | 2 | - | 2 | - | | |
| OJT/FP/CEP/C C/RP | **PTCGHT** /CC/P/176 | Yoga Education/sport and fitness | - | 4 | - | 2 | 2 | |
| Total | | | 13 | 18 | 13 | 09 | 22 | |

## PTCGHT/SEC/T/150 Plant Protoplast Culture

**Learning Objectives of the Course:** To provide students with-

1. Develop a thorough understanding of the fundamentals of protoplast culture and detailed protocols for isolating and culturing protoplasts

2. Acquire the practical skills to evaluate and apply various protoplast fusion techniques—ranging from spontaneous, induced, mechanical, and chemical fusion to electrofusion.

**Course Outcomes ( COs) :**

On completion of the course, students should be able to -

1: Explain the historical background, underlying principles, and standard protocols for isolating and culturing protoplasts, including the action of enzymes like cellulase and pectinase

2: Execute the isolation of protoplasts from plant tissues using proper enzymatic treatments, culture them under controlled conditions, and assess their key properties and viability.

3: Apply a range of protoplast fusion methods—such as spontaneous, induced, mechanical, chemical fusion, and electrofusion—and critically evaluate their effectiveness for applications in plant biotechnology.

**Marks:-50** **Total Contact Hours (30 Periods)**

**Unit I**: **Introduction**; history of protoplast culture

**Unit II**: Principle; protocol for isolation and culture of protoplast;

**Unit III**: Action of cellulose and pectinase. Macerozyme on plant cell;

Unit IV: Important properties of isolated protoplast, Importance of protoplast culture.

Unit V: Introduction methods in Protoplast fusion-spontaneous fusion; Induced fusion; Mechanical fusion; Chem-Fusion, eletrofusion

**Reference Books:-**


Kenneth L. Giles (2013). Plant Protoplasts. This book covers techniques involved with protoplast technology, including isolation, fusion, and culture of higher plant protoplasts.

S. S. Bhojwani and V. K. Razdan (1983). Plant Tissue Culture: Techniques and Applications. This book provides comprehensive information on various plant tissue culture techniques, including protoplast culture.

P. S. Bajaj (1995). Plant Cell, Tissue and Organ Culture: Fundamental and Applied Aspects. This book includes detailed chapters on protoplast isolation and culture.

R. N. S. Gautham (2012). Plant Tissue Culture: Principles and Practices. This book offers insights into various plant tissue culture methods, including protoplast culture.

K. Lindsey and M. J. Hall (1988). Plant Tissue Culture Manual (Vol. 1). Springer. This book provides practical protocols for plant tissue culture, including protoplast culture techniques.

J. Reinert and Y. P. S. Bajaj (1977). Applied and Fundamental Aspects of Plant Cell, Tissue, and Organ Culture. Springer. This comprehensive book covers various aspects of plant cell culture, including protoplast culture.

I. K. Vasil (1980). Perspectives in Plant Cell and Tissue Culture. Academic Press. This book offers detailed information on plant cell and tissue culture techniques, with a section dedicated to protoplast culture.

T. A. Thorpe (1981). Plant Tissue Culture: Methods and Applications in Agriculture. Academic Press. This book provides an in-depth look at plant tissue culture methods, including protoplast culture.

**PTCGHT/DSC/P/176 Practical's Based on PTCGHT/SEC/T/150 Plant Protoplast Culture**

**Learning Objectives of the Course:** To provide students with-

1. Develop practical proficiency in protoplast isolation and culture by mastering protocols to isolate protoplasts from plant tissues, assessing their viability, and establishing robust protoplast cultures.

2. Acquire expertise in in vitro regeneration techniques by successfully initiating and manipulating shoot initiation, differentiation, and multiplication—including root initiation, single cell culture, and regeneration from shoot tip, axillary bud, and meristem cultures—to regenerate complete plants.

**Course Outcomes ( COs) :**

On completion of the course, students should be able to -

1: Proficiently execute the isolation of protoplasts using standard protocols and assess their viability to ensure high-quality cell preparations for further culture.

2: Successfully apply various tissue culture techniques including in vitro shoot initiation, differentiation, multiplication, and root induction to regenerate complete plants from isolated cells.

3: Effectively perform single cell culture and initiate regeneration from shoot tip, axillary bud, and meristem cultures to produce genetically uniform plantlets through clonal propagation.

Marks:-50 Total contact Hours:-60

**List of Experiments**

1) Protocol for isolation of protoplast.

2) Protoplast Culture techniques.

3) Viaility of protoplast

4) In vitro shoot initiation, differentiation and multiplication

4) Root initiation and differentiation.

5) Single cell culture.

6) Shoot tip, auxillary bud, Meristem culture

**PTCGHT/SEC/T/151 Hardening of Plants**

**Learning Objectives of the Course:** To provide students with-

1. Develop practical proficiency in protoplast isolation and culture by mastering protocols to isolate protoplasts from plant tissues, assessing their viability, and establishing robust protoplast cultures.

2. Acquire expertise in in vitro regeneration techniques by successfully initiating and manipulating shoot initiation, differentiation, and multiplication including root initiation, single cell culture, and regeneration from shoot tip, axillary bud, and meristem cultures—to regenerate complete plants.

**Course Outcomes ( COs) :**

On completion of the course, students should be able to -

1: Demonstrate proficiency in rooting in vitro plantlets and applying appropriate hardening protocols to facilitate a successful transition to ex vitro conditions.

2: Design and prepare optimal plant pot mixtures using various composts, chemical fertilizers, and other soil amendments to support the acclimatization and healthy growth of plantlets.

3: Evaluate the role of controlled environments (e.g., polyhouses, net houses) and select suitable potting and repotting strategies to enhance the hardening process and improve plant establishment.

**Marks:-50** **Total Contact Hours (30 Periods)**

**Unit I: Rooting and hardening of in vitro plantlets**

**Unit II: Hardening**: Hardening stages, Role of Polyhouse, Net House,

**Unit III: Compost**, types of compost, Chemical fertilizer, Cocopit,

**Unit IV: Soil in hardening**. Plant pot mixture, Potting and repotting, selection of pot for different plants, different types of potting medium.

**Reference Books:-**


Jacobs, D. F., Landis, T. D., & Wilkinson, K. M. (1999). Hardening. In Tropical Nursery Manual. Timber Press.

Dumroese, R. K., & Landis, T. D. (2004). Plant Hardiness and Nursery Practices. In Restoration and Reforestation of Boreal and Temperate Forests (pp. 123-145). Springer.

Westwood, M. N. (1988). Temperate-zone Pomology. Timber Press.

Adams, C. (2023). What is Hardening in Agriculture? Agruculture Lore. Retrieved from Agriculture Lore

M. K. Razdan Plant tissue culture by.

Kalyan Kumar De Plant tissue culture by Kalyan Kumar De.

**PTCGHT/SEC/P/177-114 Practical's Based on PTCGHT/SEC/T/151**

**Learning Objectives of the Course:** To provide students with-

1. Develop practical skills in selecting and preparing appropriate pots and media for plant hardening.

2. Acquire proficiency in diverse propagation techniques by applying methods tailored to horticultural, medicinal, and aromatic plants, ensuring effective plant establishment and growth.

**Course Outcomes ( COs) :**

On completion of the course, students should be able to -

1: Evaluate and select appropriate pots, media, and pot mixtures, and apply various hardening methods to ensure the successful transition of in vitro plantlets to ex vitro conditions.

2: Execute ex-agar plant production, along with efficient potting and repotting techniques, to support robust plant growth and acclimatization.

3: Demonstrate proficiency in specialized propagation techniques tailored for horticultural, medicinal, and aromatic plants, thereby enhancing plant diversity and commercial potential.

Marks:-50 Total contact Hours:-60

**List of the Practical's**

1) Types of Pots and media for plant hardening

2) Ex agar plant

3) Potting and re-potting plant

4) Pot mixture preparation

5) Hardening methods and their utility.

6) Propagation of horticultural.

7) Propagation of Medicinal plants.

8) Propagation of Aromatic plants.

**PTCGHT/SEC/T/152 Basics of Controlled Environment Plantations**

**Learning Objectives of the Course:** To provide students with-

1. Understand the fundamental principles, history, and current trends of controlled environment plantations, including their role in modern agriculture and the greenhouse industry.

2. Develop practical knowledge of greenhouse construction, covering materials, space utilization, and environmental control systems such as heating, cooling, lighting, and $CO_2$ enrichment to optimize

**Course Outcomes ( COs) :**

On completion of the course, students should be able to -

1: Define and critically assess the fundamentals, historical evolution, and current trends in controlled environment plantation, enabling them to understand its impact on modern agriculture.

2: Develop comprehensive designs for greenhouse structures—including selection of cover materials, bench construction, and efficient space utilization—ensuring practical, safe, and cost-effective solutions for controlled plant production.

3: Apply knowledge of heating, cooling, ventilation, lighting, and carbon dioxide enrichment systems to effectively manage greenhouse environments, optimizing conditions for enhanced plant growth and productivity.

**Marks:-50** **Total Contact Hours (30 Periods)**

**Unit I: Basics of Controlled Environment plantation** ,Definition, concept, and history, Characteristics of controlled environment plant production. Current status and trends in greenhouse industry

**Unit II: Greenhouse structure** and construction, Greenhouse cover materials.

**Unit III: Bench construction** and space utilization.in green house and shade net.

**Unit IV :Greenhouse heating**, cooling, and ventilation. Lights and lighting. Carbon dioxide enrichment.

**References books:**

1) Plant Factory: An Indoor Vertical Farming System for Efficient Quality Food Production by Toyoki Kozai

2) Hydroponic Food Production by Howard M. Resh

3) The Vertical Farm: Feeding the World in the 21st Century by Dr. Dickson Despommier

4) Controlled Environment Horticulture: Improving Quality of Vegetables and Medicinal Plants by Christoph-Martin Geilfus

5) Hydroponics for the Home Grower by Howard Resh

**PTC/DSC-116 Practical's Based on DSC-3 (M-3) Basics of Controlled Environment Plantations.**

**Learning Objectives of the Course:** To provide students with-
1. Develop practical skills in constructing and managing a greenhouse controlled environment.

2. Acquire proficiency in horticultural analysis and performing accurate fertilizer concentration calculations, and applying effective cleaning and maintenance protocols to support sustainable crop production.

**Course Outcomes ( COs) :**
On completion of the course, students should be able to -

1: Construct greenhouses, install environmental control systems including lighting, and ensure optimal conditions for plant growth.

2: Evaluate the effects of growth regulators on seed germination and successfully produce selected floral and vegetable crops under controlled conditions.

3: Conduct soil, water, and plant tissue analyses, calculate fertilizer concentrations accurately, and implement effective cleaning and maintenance protocols for sustainable greenhouse operations.

Marks:-50 Total contact Hours:-60

**List of Practical's**

1) Effect of growth regulators on seed germination.
2) Construction of Green House
3) Environmental controlling and installation.
4) Lights and Lighting construction.
5) Production of selected floral and vegetable crops
6) Handling of soil, water, and plant tissue analysis
7) Fertilizer concentration calculations
8) Cleaning and Maintenance.

**This course will be available for the students from other faculty**

**PTCGHT /GE/T/150**

**Vegetative Propagation and Grafting**

**Course type: General/ Open Elective Course Credits: 2,**

**Contact Hours: 30 clock hours, 2 hours/ week Marks: 50,**

**Learning Objectives of the Course:** To provide students with-

i) To provide an understanding of vegetative propagation and grafting techniques.

ii) To explore the scientific principles and practical applications of vegetative propagation in agriculture and horticulture.

**Course Outcomes ( COs) :**

On completion of the course, students should be able to -

i) Understand the principles and methods of vegetative propagation and grafting.

ii) Acquire practical skills to perform propagation and grafting techniques.

iii) Appreciate the significance of propagation methods in agriculture, horticulture, and conservation.

**Internal assessment: 20, External assessment: 30**

Marks:-50 Total contact Hours:-30

**Unit I: Basics of Vegetative Propagation**

1. Principles of vegetative propagation: Definition and importance
2. Natural methods: Bulbs, tubers, rhizomes, suckers, etc.
3. Artificial methods: Cutting, layering, division.

**Unit II: Grafting Techniques**

1.Introduction to grafting: Definition and significance
2. Types of grafting: Whip grafting, cleft grafting, bark grafting, approach grafting
3. Stock and scion selection and compatibility

**Unit III: Advanced Propagation Methods**

1.Budding techniques: T-budding, patch budding, ring budding
2. Micropropagation techniques (overview)
3. Use of growth regulators and plant hormones in propagation

**Unit IV: Applications of Propagation and Grafting.**

1. Role in crop improvement and production of hybrid varieties
2. Preservation and multiplication of rare plant species
3. Application in ornamental and fruit plants

Suggested reading:

1. The Grafter's Handbook by R.J. Garner

2. https://www.sas.upenn.edu/~dailey/VegetativePropagationTechniques.pdf

**PTCGHT / VSC/T/150 Soil Cultivation techniques.**

Course type: Vocational Skill Course Credits Theory: 1; Contact Hours: 15 clock hours; 1 hours/ week

Marks: 25

**Learning Objectives of the Course:** To provide students with-

1. A comprehensive understanding of soil cultivation practices by mastering the tools and techniques used for digging and mulching, managing soil fertility through application of organic and inorganic fertilizers (including biofertilizers and mycorrhiza).

2. Acquire the ability to analyse and implement effective soil conservation strategies by identifying various types and causes of soil erosion, understanding the impact of natural and anthropogenic factors and methods to prevent soil degradation—with emphasis on sustainable practices and cultural initiatives such as Vanamahotsava

**Course Outcomes ( COs) :**

On completion of the course, students should be able to -

1: Explain the tools, methods, and practices used in soil cultivation, including application of various organic and inorganic fertilizers.

2: Identify the causes and types of soil erosion and evaluate both natural and anthropogenic pressures on soil health, while designing and applying methods for effective soil conservation.

3: Develop and implement integrated soil management plans that combine soil fertility maintenance with conservation practices (such as those promoted during Vanamahotsava) to sustain long-term soil productivity and environmental quality.

**Unit-I:** Tools required for soil cultivation

Types of soil cultivation techniques- Types of digging, mulching.

Soil Fertility, Elements in plant nutrition, Nutrient cycles in soil,

Maintenance of soil fertility- Crop rotation benefits, use of organic Manures and Fertilizers, Use of manures and fertilizers,

Classification of manures and fertilizers (Bulky organic manures- FYM, compost, slurry from biogas plant, animal excreta, green manures; fertilizers- types. Biofertilizers (nitrogen fixing, phosphate solubilising), mycorrhiza

Methods of application of fertilizers.

**Unit-II:** Soil Conservation

Types of soil erosion, and agents of erosion, Natural - water, wind and accelerated erosion- natural calamities and anthropogenic pressures.

Strategies for soil conservation- physical, agronomic and agrostological methods of soil conservation. Vanamahotsava and it importance.

Role of horticultural practices in soil and water conservation.

**References**


Arora, J.S. (1990). Introductory Ornamental Horticulture. Kalyani Publishers.

Pant V, Nelson. 1991. Green House Operation and Management . Bali Publ.

Pradeepkumar T, Suma B, Jyothibhaskar & Satheesan KN. 2007. Management of Horticultural Crops. Parts I, II by New India Publications.

George Acquaah. Horticulture, Principles and Practices . Eastern Economy Eddition.

Iyengar Gopalswamy. Complete Gardening in India

Alex Lauric and Victor h Ries. Floriculture, Fundamentals and Practices . Agrobios, India

Ramachandrappa and Nanjappa. Fertigation Technology, Agrobios, India

Prasad S and Kumar U . Green House Management for Horticultural Crops. Agrobios India

Biswas T D and Mukherjee S K . Text Book of Soil Science by, Tata Mc Graw-Hill Publishing Company Limited.

Prasad S and Kumar U. Principles of Horticulture . Agrobios India

**Practical Course:** PTCGHT / VSC/P/176

**Course name: Soil Cultivation techniques**

Course type: Vocational Skill Course Credits Practical: 1; Contact Hours: 30 clock hours; 2hours/ week

Marks: 25

**Learning Objectives of the Course:** To provide students with-

1. Develop proficiency in identifying various soil types and accurately estimating critical soil parameters—such as pH, water holding capacity, and organic matter content

2. Gain comprehensive knowledge in identifying and differentiating various fertilizers (both organic and inorganic), including the role of green manure and biofertilizers, and understand the application of physical and chemical methods in assessing soil fertility.

**Course Outcomes ( COs) :**

On completion of the course, students should be able to -

1: Classify various types of soil and accurately determine key parameters such as pH, water holding capacity, and organic matter content using standardized soil testing methods and kits.

2: Identify and distinguish among inorganic fertilizers and various types of organic fertilizers, green manure plants, and biofertilizers, understanding their roles in maintaining and enhancing soil fertility.

3: Select and effectively utilize appropriate tools for soil cultivation, apply physical and chemical methods for fertilizer identification, and integrate these practices to optimize soil management and fertility.

1 Identification of types of soil.

2. Estimation of Soil pH, Water Holding Capacity of soil, Use of soil testing kit

3 Identification of Fertilizers by physical and chemical methods: Urea, Ammonium Sulphate, Potassium Sulphate, Super Phosphate Manures,

4 Plants used as green manure.

5 Types of organic fertilizers

6 Types of Biofertilizers

7 Study of tools used in soil cultivation.

8 Study of organic matter in soil and its percentage

**Theory Course:** PTCGHT / VSC/T/151**Course name: Phytoremediation**

Course type: Vocational Skill Course Credits Theory: 1; Contact Hours: 15 clock hours; 1 hours/ week

Marks: 25

**Learning Objectives of the Course:** To provide students with-

1. The concept of phytoremediation and its applications in environmental management.
2. To equip students with practical skills to use plants for remediation of soil, water, and air.
3. To prepare students for careers in Environmental Science, agriculture, and ecological restoration.

**Course Outcomes ( COs) :**

On completion of the course, students should be able to -

1: Understand the principles, techniques, and applications of phytoremediation

2: Develop the ability to select appropriate plant species for specific remediation needs.

3: Equipped with the practical skills necessary to implement phytoremediation projects.

**Unit-I:** Fundamentals of Phytoremediation

Definition and importance of phytoremediation.

Mechanisms of phytoremediation: Phytoextraction, phytostabilization, phytodegradation, and rhizofiltration.

Advantages and limitations of phytoremediation.

**Unit-II:** Contaminants and Target Sites.

Types of contaminants: Heavy metals, organic pollutants, hydrocarbons, radionuclides.

Selection criteria for contaminated sites: Soil, water, and air remediation.

Role of the rhizosphere and microbial interactions in remediation.

**Unit-III:** Plants in Phytoremediation.

Selection of plant species for specific contaminants.

Characteristics of hyperaccumulator plants.

Role of genetically modified plants in phytoremediation.

Techniques and Implementation and Examples of successful phytoremediation projects worldwide.

**References**

Phytoremediation Management of Environmental Contaminants, Volume 4 by Abid A. Ansari, Sarvajeet Singh Gill Ritu Gill, Guy R. Lanza, Lee Newman

https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000014ER/P000284/M026110/ET/1515056403paper15_module_13_etext.pdf

https://www.clu-in.org/download/remed/introphyto.pdf

https://egyankosh.ac.in/bitstream/123456789/95598/1/Unit-12.pdf

**Practical Course:** PTCGHT / VSC/P/177

Course type: Vocational Skill Course Credits Practical: 1; Contact Hours: 30 clock hours; 2hours/ week

Marks: 25

**Learning Objectives of the Course:** To provide students with-

1. To provide hands-on experience in soil, water, and plant sampling techniques for remediation purposes.

2. To train students in identifying hyperaccumulator plants and their specific applications in phytoremediation projects.

**Course Outcomes ( COs) :**

On completion of the course, students should be able to -

1: Students will acquire skills in collecting, analyzing, and interpreting soil and water samples for contamination levels.

2: They will demonstrate the ability to select and use appropriate plant species for remediation based on contaminants and environmental factors..

3: Students will successfully design and monitor phytoremediation projects, evaluating their effectiveness and environmental impact.

1 Identification of hyperaccumulator plants and their remediation potential

2. Soil and water sampling from contaminated sites

3 Designing and setting up a phytoremediation experiment (e.g., heavy metal remediation using selected plants)

4 Monitoring plant growth and contamination removal efficacy.

5 Field visit to a phytoremediation project or ecological restoration site