# Syllabus of 4 + 1 Year Integrated UG and PG Programme

**w. e. f 2024-25 Academic Year**


**GRADUATE SCHOOL**

**Mahatma Gandhi University**

**P. D. Hills P O**

**Kottayam, Kerala**

**www.gs.mgu.ac.in**

**www.mgu.ac.in**

# Schools offering Majors

| SL.No | School/Centre |
|---|---|
| 1 | School of Bio Sciences |
| 2 | School of Chemical Sciences |
| 3 | School of Computer Sciences |
| 4 | School of Environmental Sciences |
| 5 | School of Gandhian Thought and Development Studies |
| 6 | School of International Relations and Politics |
| 7 | School of Pure and Applied Physics |
| 8 | School of Social Sciences |

| Sl. No. | Major | Intake |
|---|---|---|
| **SCIENCE** | | |
| 1 | Bio Sciences | 6** |
| 2 | Chemistry | 6 |
| 3 | Computer Science | 6 |
| 4 | Environmental Science | 6 |
| 5 | Physics | 6 |
| **SOCIAL SCIENCES** | | |
| 1 | Development Studies | 5 |
| 2 | Gandhian Studies | 5 |
| 3 | History | 10 |
| 4 | International Relations and Politics | 10 |

**Majors offered and Intake** *1 seat shall be sanctioned over and above the intake in each major in the 3rd semester for students who opt for a change of major after two semesters.

**Progression to PG Shall be based on the specialization selected by students as Biochemistry (2 seats) Biotechnology (2 seats) and Microbiology (2 seats) based on merit.

# Schools offering Minors/MDCs/AECs/VACs/SECs

| SL.No | School/Centre |
|---|---|
| 1 | School of Artificial Intelligence And Robotics |
| 2 | School of Behavioural Sciences |
| 3 | School of Biosciences |
| 4 | School of Chemical Sciences |
| 5 | School of Computer Sciences |
| 6 | School of Data Analytics |
| 7 | School of Energy Materials |
| 8 | School of Environmental Sciences |
| 9 | School of Food Science And Technology |
| 10 | School of Gandhian Thought And Development Studies |
| 11 | School of Gender Studies |
| 12 | School of Indian Legal Thought |
| 13 | School of International Relations And Politics |
| 14 | School of Letters |
| 15 | School of Mathematics And Statistics |
| 16 | School of Nanoscience And Nano Technology |
| 17 | School of Pedagogical Sciences |
| 18 | School of Polymer Science And Technology |
| 19 | School of Pure And Applied Physics |
| 20 | School of Social Sciences |
| 21 | School of Tourism Studies |
| 22 | International and Inter University Centre for Nanoscience and Nanotechnology |
| 23 | K N Raj School of Economics |

**Scheme for 4 + 1 Integrated UG and PG Programme**
**Graduate School**
**Mahatma Gandhi University**
**National Institute of Plant Science Technology**

| Course Code | Title | Credits | Hours per Week | | Level | Type |
|---|---|---|---|---|---|---|
| | | | Theory | Practicals | | |
| **SEMESTER I** | | | | | | |
| MG1DSCUBP121 | The science of plants | 4 | 60 | 0 | Foundation (100-199) | Minor |
| MG1DSCUBP141 | Understanding Plant Physiology | 4 | 60 | 0 | " | Minor |
| MG1DSCUBP142 | Essential Concept in Plant Biochemistry | 4 | 60 | 0 | " | Minor |
| MG1MDCUBP101 | From Cells to Ecosystems | 3 | 45 | 0 | " | MDC |
| **SEMESTER II** | | | | | | |
| MG2DSCUBP121 | Recent advances and applications in plant science | 4 | 60 | 0 | " | Minor |
| MG2DSCUBP141 | Comprehensive Insights on Herbal Medicine | 4 | 60 | 0 | " | Minor |
| MG2MDCUBP101 | Fungi: From Culinary Delights to Biotechnological Marvels | 3 | 45 | 0 | " | MDC |
| **SEMESTER III** | | | | | | |
| MG3DSCUBP221 | Economic and Biotechnological Opportunities of Thallophytes | 4 | 40 | 20 | Intermediate (200-299) | Minor |
| MG3MDCUBP201 | Taming the Invaders: Strategies for Invasive Species | 3 | 45 | 0 | " | MDC |

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|---|---|---|---|---|---|---|
| | Management | | | | | |
| MG3VACUBP201 | Cells in Bloom: Mastering the Techniques of Tissue Culture | 3 | 30 | 15 | " | VAC |
| **SEMESTER IV** | | | | | | |
| MG4DSCUBP241 | An introduction to vascular cryptograms | 4 | 45 | 15 | " | Minor |
| MG4SECUBP201 | Insights into Phytochemical Isolation | 3 | 30 | 15 | " | SEC |
| MG4VACUBP201 | Horticulture and nursery management | 3 | 45 | 0 | " | VAC |
| **SEMESTER V** | | | | | | |
| MG5SECUBP301 | Techniques for Advanced Plant Research | 3 | 35 | 10 | Higher (300-399) | SEC |
| MG5VACUBP301 | The Essentials of Organic Farming | 3 | 35 | 10 | " | VAC |
| **SEMESTER VI** | | | | | | |
| MG6SECUBP301 | Conservation Biology | 3 | 35 | 10 | " | SEC |
| MG6SECUBP302 | Ecotourism: A new possibility in Kerala | 3 | 35 | 10 | " | SEC |
| **Total Credits** | | **58** | | | | |

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|---|---|---|---|---|---|---|
| **SEMESTER VII** | | | | | | |
| MG7DSCUBP421 | Angiosperm- The flowering plants & biodiversity assessment | 4 | 45 | 15 | Advanced (400-499) | Minor |
| **Total Credits** | | **4** | | | | |

*Only for 4-Years Honours Students
**Only for students who opt for theory courses instead of Research Project

*Note: General foundations courses shall be offered by different schools. Students can flexibly choose the courses across disciplines.*

| **Level** | Foundation (100-199 | Intermediate (200-299) | Higher (300-399) | Advanced (400-499) | PG Level (500-599) |
|---|---|---|---|---|---|

| **Type** | Major | Minor | MDC | SEC | VAC | AEC |
|---|---|---|---|---|---|---|

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|---|---|
| | **MAHATMA GANDHI UNIVERSITY**<br>**Graduate School** |
| | **4 + 1 Integrated UG and PG Programme** |

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|---|---|---|---|
| **School** | National Institute of Plant Science Technology (NIPST) | | |
| **Programme** | **M.Sc. Botany & Plant Science Technology** | | |
| **Course Title** | **The Science of Plants** | | |
| **Course Type** | Minor | | |
| **Course Level** | 100-199 | | |
| **Course Code** | MG1DSCUBP121 | | |
| **Course Overview** | This is a foundational course for undergraduate students, covering the basics of plant science. It gives a general introduction to the way how plants live and reproduce. The objective of the study is to understand how plants are used to produce food, alter environments, restore damaged landscapes, improve human health and well-being, improve community environments, and provide recreational and practical benefits to the public. | | |
| **Semester** | 1 | **Credit** | 4 |
| **Total Student Learning Time** | **Instructional hours for theory** | **Instructional hours for practical/lab work/field work** | |
| | 60 | 0 | |
| **Pre-requisite** | | | |

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|---|---|
| | Basics of Biology in the 12 th standard |

**COURSE OUTCOMES (CO)**

| CO No. | Expected Course Outcome<br>*Upon completion of this course, students will be able to;* | Learning Domains | PSO No. |
|---|---|---|---|
| 1 | **CO1:** To impart knowledge on origin, evolution, structure, reproduction of plants and phytogeography | R/U | |
| 2 | **CO2:** Understand the plant diversity and its classification | R/U/An | |
| 3 | **CO3:** Identify the various areas allied to plant science | U/An/A | |
| 4 | **CO4:** Analyse how plants and humans are interdependent | R/U/A | |

*(Learning Domains: Remember (R ), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

**COURSE CONTENT**

| Module 1 | Hours | CO No |
|---|---|---|
| **Plant life:**<br><br>Why life in plants and animals, differences between plants and animals. Source of energy to life – producers.<br><br>Origin of life, origin of plants / photosynthesis.<br><br>Non motile life forms – rigid cells, tissue and structures – absorptive and assimilatory regions. Aquatic and terrestrial plant forms<br><br>Plant associations – forests, various forms, phytogeography - endemism<br><br>Reproduction – fertilization and meiosis. alternation of generations, life cycles. | **20 hr** | 1 |

| **Module 2** | **Hours** | |
|---|---|---|
| **Diversity of plant life:**<br><br>Various groups of plants- algae, fungi, bryophytes, Pteridophytes, gymnosperms, and angiosperms.<br><br>Plant taxonomy and classification Biosystematics | **15 hr** | 2 |
| **Module 3** | **Hours** | |
| **Branches of plant science:**<br><br>Morphology, Anatomy, Plant physiology, Plant biochemistry, Plant genetics, Plant breeding, Plant ecology, Horticulture, Plant biotechnology, Plant evolution, etc. | **10 hr** | 3 |
| **Module 4** | **Hours** | |
| **Plants and human beings:**<br><br>Plant diversity and human welfare – Economic botany, ecosystem services – climate change and global warming.<br><br>Plants: various sources of human needs – food, shelter, medicine etc.<br><br>Future prospects in plant science studies. | **15 hr** | 4 |

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| **Mode of Transaction** | **Classroom activities:** Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning, interactive Instruction:, Active co-operative learning, Seminar, Group Assignments Authentic learning, , Library work and Group discussion, Presentation by individual student/ Group representative<br><br>**Field activities:**<br><br>**Lab based activities:** |
| **Mode of Assessment** | 1. Internal Tests of maximum 20 marks<br><br>2. Seminar Presentation – a theme is to be discussed and identified to prepare a paper and present in the seminar - 10 mark<br><br>3. Write a detailed report on a given topic based on research findings-10 marks<br><br>Semester End examination – 60 marks |

**Learning Resources**


1. The science of plants: Inside Their Secret World by Katherine J. Willis, DK publishers, 2022, ISBN 0744048435

2. Textbook of Botany by O. P Sharma, Vol.1, 2nd Edn, 2023

3. An introduction to plant biology by James D. Mauseth, ISBN 9781449648848, 2012


| **Relevance of Learning the Course/ Employability of the Course** |
| --- |
| *'The Science of Plants'* helps the students to understand the mysterious inner workings of the plant world. The topics covered in this course are relevant for an introductory plant science class at an undergraduate level. |

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| | **MAHATMA GANDHI UNIVERSITY**<br><br>**Graduate School** |
| | **4 + 1 Integrated UG and PG Programme** |

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|---|---|---|---|
| **School** | National Institute of Plant Science Technology(NIPST) | | |
| **Programme** | **4 + 1 Integrated UG and PG Programme** | | |
| **Course Title** | **Understanding Plant Physiology** | | |
| **Course Type** | Minor | | |
| **Course Level** | 100-199 | | |
| **Course Code** | MG1DSCUBP141 | | |
| **Course Overview** | Plant Physiology is a foundational course for undergraduate students, offering a comprehensive introduction to the vital processes and functions of plants. The course covers the mechanisms of plant growth, development, and responses to environmental stimuli, with a focus on the biochemical and physiological processes that underpin these functions. This course is typically divided into 4 modules, with each module covering specific areas of plant physiology. | | |
| **Semester** | 1 | **Credit** | 4 |
| **Total Student Learning Time** | **Instructional hours for theory** | **Instructional hours for practical/lab work/field work** | |
| | 60 | 0 | |
| **Pre-requisite** | Understanding of basic science | | |

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## COURSE OUTCOMES (CO)

| CO No. | Expected Course Outcome | Learning Domains | PSO No. |
|---|---|---|---|
| | *Upon completion of this course, students will be able to;* | | |
| 1 | Understand the fundamental physiological processes in plants. | R/U | |
| 2 | To understand and explain the mechanisms of different metabolism in plants and also their variations across different environmental conditions and plant types. | U/A | |
| 3 | To identify plant hormone responses | R/U/A | |
| 4 | Analyze how plants respond to environmental stimuli and stress conditions. | U/An | |

*(Learning Domains: Remember (R ), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

## COURSE CONTENT

| Module 1 | Hours | CO No |
|---|---|---|
| **WaterTransport:**Basics of water movement in plants, Transpiration and its role in water movement<br><br>**Nutrient Transport:**Essential nutrients for plants, Mechanisms of nutrient uptake | **10 hr** | 1 |
| **Module 2** | **Hours** | |
| **Photosynthesis:** Overview of chloroplasts and photosynthetic pigments, Light-dependent and light-independent reactions (Calvin cycle), Differences between C3, C4, and CAM plants<br><br>**Respiration:** Cellular respiration process: glycolysis, Krebs cycle,Role of mitochondria, electron transport chain. | **20 hr** | 1, 2 |
| **Module 3** | **Hours** | |
| **Nitrogen metabolism:** Atmospheric nitrogen fixation, nitrogen cycle, nitrogen assimilation | **20 hr** | 1, 2 |

| | | |
|---|---|---|
| **Phytohormones:** Types, functions, and mechanisms of action.<br><br>**Growth and Development:** Cell division and expansion, Differentiation and morphogenesis, Root and shoot growth patterns | | |
| **Module 4** | **Hours** | |
| **Plant-Environment Interactions:** Plant stress, Responses to light, temperature, and water availability<br>**Plant-microbe interactions:** symbiosis and pathogenesis | **10 hr** | 4 |

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| **Mode of Transaction** | **Classroom activities:**Direct Instruction: Brainstorming lecture, Explicit Teaching, E-learning, interactive Instruction:, Active co-operative learning, Seminar, Group Assignments Authentic learning, , Library work and Group discussion, Presentation by individual student/ Group representative<br><br>**Field activities:**<br><br>**Lab based activities** |
| **Mode of Assessment** | **Continuous Internal Assessment (CIA)**<br><br>1. Internal Tests of maximum 20 marks<br><br>2. Seminar Presentation – a theme is to be discussed and identified to prepare a paper and present in the seminar - 10 mark<br><br>3. Write a detailed report on a given topic based on research findings-10 marks<br><br>Semester End examination – 60 marks |

## Learning Resources

1. Heldt, Hans-Walter, and Birgit Piechulla. *Plant biochemistry*. Academic Press, 2021.

2 Taiz L and E Zeiger (2010) Plant Physiology, Sinauer Associates

3. Peter Scott (2008) Physiology and Behaviour of Plants,Wiley-Blackwell

| |
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| **Relevance of Learning the Course/ Employability of the Course** |

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| Understanding plant physiology is crucial for undergraduate students as it provides essential knowledge about how plants function, grow, and interact with their environment, forming the basis for advances in agriculture, biotechnology, and environmental science. |

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| | **MAHATMA GANDHI UNIVERSITY**<br><br>**Graduate School** |
| | **4 + 1 Integrated UG and PG Programme** |

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|---|---|---|---|
| **School** | National Institute of Plant Science Technology(NIPST) | | |
| **Programme** | 4 +1 integrated UG and PG programme | | |
| **Course Title** | Essential Concepts in Plant Biochemistry | | |
| **Course Type** | Minor | | |
| **Course Level** | 100-199 | | |
| **Course Code** | MG1DSCUBP142 | | |
| **Course Overview** | This course provides an in-depth understanding of the structure, function, and classification of biomolecules essential for biological systems. Topics include carbohydrates, proteins, lipids, and nucleic acids, with a focus on their roles in cellular processes and organismal function. | | |
| **Semester** | 1 | **Credit** | 4 |
| **Total Student Learning Time** | **Instructional hours for theory** | **Instructional hours for practical/lab work/field work** | |
| | 60 | 0 | |
| **Pre-requisite** | Understanding of basic science | | |

## COURSE OUTCOMES (CO)

| CO No. | Expected Course Outcome | Learning Domains | PSO No. |
|---|---|---|---|
| | *Upon completion of this course, students will be able to;* | | |
| 1 | To understand the diverse array of biomolecules essential | U | 1 |

| | | | |
|---|---|---|---|
| | for life | | |
| 2 | Describe the structure, function, and classification of biomolecules. | U/A | 1,2 |
| 3 | To elucidate how various biomolecules interact and collaborate within intricate living systems to execute coordinated functions | A/An | 1,2 |
| 4 | To contrast the structures and functionalities of biomolecules within plant systems. | A | 1,3 |

*(Learning Domains: Remember (R ), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

**COURSE CONTENT**

| **Module 1** | **Hours** | **CO No** |
|---|---|---|
| **Carbohydrates:** Classification, monosaccharides, open chain and cyclic structures, epimers and anomers, mutarotation, reactions of carbohydrates (due to functional groups - hydroxyl, aldehyde and ketone). Structure and biological importance of disaccharides (sucrose, lactose, maltose), structural polysaccharides (cellulose, chitin, pectin) and storage polysaccharides (starch, inulin), Glycosides | **20 hr** | **1,2,3,4** |
| **Module 2** | **Hours** | |
| **Amino acids & Proteins**: Structure, function and classification of amino acids, Peptides: Formation of peptide bond. Proteins: Classification based on solubility, shape and function. Structural organization of proteins- primary, secondary, tertiary and quaternary structures. | **15 hr** | **1,2,3,4** |
| **Module 3** | **Hours** | |
| **Lipids-**Lipids: Classification of lipids with examples, classification of fatty acids, chemical constants of fatty acids-saponification number, acid number, iodine number and their application. Steroids: Structure of steroid nucleus:- cholesterol, ergosterol, stigmasterol | **20 hr** | **1,2,3,4** |
| **Module 4** | **Hours** | |
| **Nucleic Acids:** Nature of nucleic acids, Structure of purines and pyrimidines, nucleosides, nucleotides, Stability and formation of Phosphodiester linkages, Watson -Crick model of DNA structure. Types of DNA and RNA | **5 hr** | **1,2,3,4** |

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| **Mode of** | **Classroom activities:**Direct Instruction: Brainstorming lecture, Explicit Teaching, |

| | |
|---|---|
| **Transaction** | E-learning, interactive Instruction:, Active co-operative learning, Seminar, Group Assignments Authentic learning, , Library work and Group discussion, Presentation by individual student/ Group representative<br><br>**Field activities:**<br><br>**Lab based activities** |
| **Mode of Assessment** | **Continuous Internal Assessment (CIA)**<br><br>1. Internal Tests of maximum 20 marks<br><br>2. Seminar Presentation – a theme is to be discussed and identified to prepare a paper and present in the seminar-Maximum marks 10<br><br>3. Write a detailed report on a given topic based on research findings - Maximum marks 10<br><br>Semester End examination – 60 marks |

## Learning Resources

1. Lehninger Principles of Biochemistry, Fourth Edition by David L. Nelson, Michael M. CoxPublisher: W. H. Freeman; Fourth Edition edition (April 23, 2004) ISBN-10: 0716743396 ISBN-13: 978-0716743392

2. Biochemistry 6th Edition (2007) by Jeremy M.berg John L.tymoczko Lubert Stryer Publisher: B.i.publicationsPvt.Ltd ISBN:071676766X ISBN-13: 9780716767664, 978-716767664

| **Relevance of Learning the Course/ Employability of the Course** |
|---|
| Studying essential concepts in plant biochemistry is crucial for undergraduate students as it provides a foundational understanding of the biomolecules that drive plant life processes. |

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|---|---|
| | **MAHATMA GANDHI UNIVERSITY**<br><br>**Graduate School** |
| | **4 + 1 Integrated UG and PG Programme** |

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|---|---|---|---|
| **School** | National Institute of Plant Science Technology(NIPST) | | |
| **Programme** | **4 +1 integrated UG and PG programme** | | |
| **Course Title** | From Cells to Ecosystems | | |
| **Course Type** | MDC | | |
| **Course Level** | 100-199 | | |
| **Course Code** | MG1MDCUBP101 | | |
| **Course Overview** | This interdisciplinary course offers a comprehensive exploration of biological systems, with a specific focus on plant biology, ranging from cellular processes to ecosystem dynamics. Students will delve into the structure and function of plant cells, population ecology, community interactions, and ecosystem processes. Emphasis will be placed on understanding plant-specific concepts and their ecological significance. | | |
| **Semester** | 1 | **Credit** | 3 |
| **Total Student Learning Time** | **Instructional hours for theory** | **Instructional hours for practical/lab work/field work** | |
| | 45 | 0 | |
| **Pre-requisite** | High school biology or equivalent | | |

## COURSE OUTCOMES (CO)

| CO | Expected Course Outcome | Learning | PSO No. |
|---|---|---|---|

| No. | | Domains | |
|---|---|---|---|
| | *Upon completion of this course, students will be able to;* | | |
| 1 | Understand the organization and functioning of plant cells and their organelles | R/U/An | |
| 2 | Examine the organization of plants at tissue, organ, and system levels and their adaptation patterns | U/An | |
| 3 | Investigate plant population dynamics, community ecology, and ecosystem processes. | R/U/An | |
| 4 | Analyze the ecological significance of plants in terrestrial and aquatic ecosystems. | U/An/A | |

*(Learning Domains: Remember (R ), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

**COURSE CONTENT**

| **Module 1** | **Hours** | **CO No** |
|---|---|---|
| **Cell Structure:** Cell structure and function, Organelles and their roles | **10 hr** | **1** |
| **Module 2** | **Hours** | |
| **Plant Organ Systems and Adaptations:**Plant tissue organization, Root and shoot systems, Leaf anatomy and function, Morphological adaptations in plants | **10 hr** | **1, 2** |
| **Module 3** | **Hours** | |
| **Co-evolution and Plant-Animal Interactions:** Coevolution with pollinators, Co-evolution with herbivores, Mutualistic relationships (e.g., seed dispersers, protective ants)<br><br>**Plant Ecology and Community Dynamics:**Plant population dynamics, Plant community structure and interactions, Plant communications | **15 hr** | **2, 3,4** |
| **Module 4** | **Hours** | |
| **Plant Ecosystems and Environmental Interactions:**Plant roles in terrestrial and aquatic ecosystems, Energy flow and nutrient cycling in plant ecosystems, Human impacts on plant communities and ecosystems | **10 hr** | **3, 4** |

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| **Mode of Transaction** | **Classroom activities:**Direct Instruction: Brainstorming lecture, Explicit Teaching, E-learning, interactive Instruction:, Active cooperative learning, Seminar, Group Assignments Authentic learning, , Library work and Group discussion, Presentation by individual student/ Group representative<br><br>**Field activities:**<br><br>**Lab based activities** |
| **Mode of Assessment** | **Continuous Internal Assessment (CIA)**<br><br>1. Internal Tests of maximum 20 marks<br><br>2. Seminar Presentation – a theme is to be discussed and identified to prepare a paper and present in the seminar - 10 mark<br><br>3. Write a detailed report on a given topic based on research findings-10 marks<br><br>Semester End examination – 60 marks |

## Learning Resources

1. Molecular Biology of the Cell by Bruce Alberts, Alexander Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts, and Peter Walter

2. Botany: An Introduction to Plant Biology" by James D. Mauseth.

3. Community Ecology by Gary G. Mittelbach and Brian J. McGil

| **Relevance of Learning the Course/ Employability of the Course** |
|---|
| The course "From Cells to Ecosystems" is highly relevant for undergraduate students, offering a well-rounded education in biology that spans from cellular mechanisms to ecological interactions. |

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| | **MAHATMA GANDHI UNIVERSITY**<br><br>**Graduate School** |
| | **4 + 1 Integrated UG and PG Programme** |

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|---|---|---|---|
| **School** | National Institute of Plant Science Technology (NIPST) | | |
| **Programme** | **M.Sc. Botany & Plant Science Technology** | | |
| **Course Title** | **Recent advances and applications in plant sciences** | | |
| **Course Type** | Minor | | |
| **Course Level** | 100-199 | | |
| **Course Code** | MG2DSCUBP121 | | |
| **Course Overview** | The aim of this course is to identify how new technologies can and will transform plant science to address the challenges of new biology. This course assesses where we stand today regarding current technologies and to address questions about where we may go in the future and whether we can get an idea of what is at and beyond the horizon. | | |
| **Semester** | 2 | **Credit** | 4 |
| **Total Student Learning Time** | **Instructional hours for theory** | **Instructional hours for practical/lab work/field work** | |
| | 60 | 0 | |
| **Pre-requisite** | Understanding of basic science | | |

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## COURSE OUTCOMES (CO)

| CO No. | Expected Course Outcome | Learning Domains | PSO No. |
|---|---|---|---|
| | *Upon completion of this course, students will be able to;* | | |
| 1 | **CO1:** Understand the history and gap areas of plant science research | R/U | |
| 2 | **CO2:** Analyse the recent advances in plant science and the future prospects | R/U/An | |
| 3 | **CO3:** Understand the interdisciplinary perspectives in plant science | U/An/A | |
| 4 | **CO4:** Identify the new technologies and its applications for betterment of humankind | R/U/A | |

*(Learning Domains: Remember (R ), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

## COURSE CONTENT

| Module 1 | Hours | CO No |
|---|---|---|
| **History of plant science researches:**<br>Major findings and milestones of plant science research.<br>Important scientists and their contributions<br>Gap areas in plant science research.<br>21st Century the 'Bio Century' | **10 hr** | 1 |
| **Module 2** | **Hours** | |
| **Recent advances in plant science research:**<br>New areas of research – nano biotechnology, forensic science, climate change-carbon sink, plants and global warming.<br>Future prospects in plant science research. | **10 hr** | 2 |

| | | |
|---|---|---|
| | | |
| **Module 3** | **Hours** | |
| **Interdisciplinary approaches and new applications:**<br><br>New sources for medicines: ethnomedicine, vaccines, etc<br><br>Conventional and new sources: energy: bio-fuels – energy plantations, bioplastics, biopesticides, bio-flavourings and bio-colours for food and cosmetics.<br><br>Application of plant sources in net zero carbon emission – carbon sink, Application in nature disasters: prediction and prevention of landslides etc.<br><br>New combinations of plant science studies and research:<br>Bioinformatics etc | **20 hr** | 3 |
| **Module 4** | **Hours** | |
| **New technologies for plant science research:**<br><br>Gene replacement/editing technology, artificial chromosomes, manipulation of gene and protein functions, biosensors for plant hormones, plant communications-agriculture, remote sensing of photosynthetic efficiency, stress resilient crops, etc | **20 hr** | 4 |

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|---|---|
| **Mode of Transaction** | **Classroom activities:** Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning, interactive Instruction:, Active co-operative learning, Seminar, Group Assignments Authentic learning, , Library work and Group discussion, Presentation by individual student/ Group representative<br><br>**Field activities:** |

| | |
|---|---|
| | **Lab based activities:** |
| **Mode of Assessment** | **Continuous Internal Assessment (CIA)**<br>**1. Internal** Tests of maximum 20 marks<br>2. Seminar Presentation – a theme is to be discussed and identified to prepare a paper and present in the seminar Maximum marks 10<br>3. Write a detailed report on a given topic based on research findings -10 mark<br>**Semester End examination – 60 marks** |

## Learning Resources


1. Bulchandani, Bhagwan & Chahal, Kavita & Parashurama, Dr. T.R & Patil, Minal. (2022). Advances in Plant Science Volume IV.
2. Technological Advancements in Plant Sciences by **Raghvendra Pratap Narayan, Durgesh K. Tripathi, Rajarshi Kumar Gaur**

**3.** Plant biotechnology: the genetic manipulation of plants, 2nd edn by Adrian slatter, oxford publishers


| **Relevance of Learning the Course/ Employability of the Course** |
|---|
| Plant science is a forerunning field of study that could address the foremost disputes facing humanity in the 21st century; coupled with the development of new tools and techniques, it could aid in finding solutions to diagnose these unsolved questions. This course summarizes the recent technological advances of plant science. |

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| | **MAHATMA GANDHI UNIVERSITY**<br><br>**Graduate School** |
| | **4 + 1 Integrated UG and PG Programme** |

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|---|---|---|---|
| **School** | National Institute of Plant Science Technology(NIPST) | | |
| **Programme** | **4 +1 integrated UG and PG programme** | | |
| **Course Title** | **Comprehensive Insights into Herbal Medicine** | | |
| **Course Type** | Minor | | |
| **Course Level** | 100-199 | | |
| **Course Code** | MG2DSCUBP141 | | |
| **Course Overview** | This course provides an in-depth exploration of herbal medicine, encompassing the principles, practices, and applications of traditional and modern herbal remedies. Students will gain comprehensive insights into the botanical, chemical, pharmacological, and therapeutic aspects of medicinal plants, along with their cultural, historical, and ethical dimensions.Gain knowledge of the historical, cultural, and philosophical foundations of herbal medicine. | | |
| **Semester** | 2 | **Credit** | 4 |
| **Total Student Learning Time** | **Instructional hours for theory** | **Instructional hours for practical/lab work/field work** | |
| | 60 | 0 | |
| **Pre-requisite** | High school biology or equivalent | | |

## COURSE OUTCOMES (CO)

| CO No. | Expected Course Outcome | Learning Domains | PSO No. |
|---|---|---|---|
| | *Upon completion of this course, students will be able to;* | | |
| 1 | Explore the historical and cultural importance of herbs in various civilizations and their significance in traditional medicine systems | R/U | |
| 2 | Conduct a comprehensive study of medicinal plants in Kerala. | R/U/A | |
| 3 | Explore the chemical constituents, pharmacological properties, and analytical techniques used in the study of medicinal plants. | U/A/An | |
| 4 | Investigate the common herbal remedies, evidence-based medicine, and safety considerations associated with herbal therapy. | U/A/E | |

*(Learning Domains: Remember (R ), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

## COURSE CONTENT

| **Module 1** | **Hours** | **CO No** |
|---|---|---|
| **Introduction to Herbal Medicine:**Historical and cultural significance of herbs in human civilization, Introduction to Indian medical system | **10** | **1** |
| **Module 2** | **Hours** | |
| **Indigenous Herbal Medicines of Kerala:** An In-Depth Study of Key Medicinal Plants:- Dashapushpam, Kanikkonna -Thumba - Kadaladi- Erukku- Karinochi Kattar Vazha- Veppu-Manjal- (Kasthuri Manjal - Mara Manjal) Shankhu Pushpam- Vayambu- Chembaratti -Tottavadi - Adalodakam Nalikeram- Muttanga- Patha thali- Naruneendi - Vayalchulli Shatavari- Kurunthotti- Avanakku- Brahmi/ Kudangal- Puliyaral | **20** | **1, 2** |
| **Module 3** | **Hours** | |
| **Phytochemical Analysis:**Chemical constituents of medicinal plants, | **20** | **2, 3** |

| | | |
|---|---|---|
| Pharmacological properties, Analytical techniques | | |
| **Module 4** | **Hours** | |
| **Therapeutic Applications:**Common herbal remedies and their uses, Evidence-based medicine in herbal therapy, Safety considerations and adverse effects, Ethnomedicine | **10** | **2, 3, 4** |

| | |
|---|---|
| **Mode of Transaction** | **Classroom activities:**Direct Instruction: Brainstorming lecture, Explicit Teaching, E-learning, interactive Instruction:, Active co-operative learning, Seminar, Group Assignments Authentic learning, , Library work and Group discussion, Presentation by individual student/ Group representative<br><br>**Field activities:**<br><br>**Lab based activities** |
| **Mode of Assessment** | **Continuous Internal Assessment (CIA)**<br><br>1. Internal Tests of maximum 20 marks<br><br>2. Seminar Presentation – a theme is to be discussed and identified to prepare a paper and present in the seminar - 10 mark<br><br>3. Write a detailed report on a given topic based on research findings-10 marks<br><br>Semester End examination – 60 marks |

## Learning Resources

1.The Ayurvedic Pharmacopoeia of India by The Government of India

2. Medicinal Plants of Kerala: A Handbook by V. Sasidharan

3.Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis by J.B. Harborne

| **Relevance of Learning the Course/ Employability of the Course** |
|---|
| By studying this course, students not only gain valuable knowledge about the medicinal plants of Kerala but also develop a holistic understanding of the interplay between traditional practices, |

modern science, and sustainable development.

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| | **MAHATMA GANDHI UNIVERSITY**<br><br>**Graduate School** |
| | **4 + 1 Integrated UG and PG Programme** |

| | | | |
|---|---|---|---|
| **School** | National Institute of Plant Science Technology(NIPST) | | |
| **Programme** | **4 +1 integrated UG and PG programme** | | |
| **Course Title** | Fungi: From Culinary Delights to Biotechnological Marvels | | |
| **Course Type** | MDC | | |
| **Course Level** | 100-199 | | |
| **Course Code** | MG2MDCUBP101 | | |
| **Course Overview** | This course focuses on the culinary aspects of fungi, exploring their diversity, flavors, and culinary applications in various cuisines around the world. Students will learn about different types of culinary fungi, their cultivation, culinary techniques, and their role in creating exquisite dishes and culinary masterpieces. | | |
| **Semester** | 2 | **Credit** | 3 |
| **Total Student Learning Time** | **Instructional hours for theory** | **Instructional hours for practical/lab work/field work** | |
| | 45 | 0 | |
| **Pre-requisite** | High school biology or equivalent | | |

## COURSE OUTCOMES (CO)

| CO No. | Expected Course Outcome | Learning Domains | PSO No. |
|---|---|---|---|

| | | | |
|---|---|---|---|
| | *Upon completion of this course, students will be able to;* | | |
| 1 | Provide an overview of fungal classification, diversity, morphology, life cycle and its importance | R/U/An | |
| 2 | Introduce students to culinary fungi, including cultivation methods, flavor profiles, and culinary applications. | U/A | |
| 3 | Explore the role of molds and yeasts in fermentation processes and introduce fungal delicacies from diverse culinary traditions. | U/A | |
| 4 | Discuss the industrial and environmental applications of fungi in biotechnology, including fermentation, bioremediation, and pharmaceutical production. | U/A/E | |

*(Learning Domains: Remember (R ), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

**COURSE CONTENT**

| **Module 1** | **Hours** | **CO No** |
|---|---|---|
| **Introduction to Fungi:** Fungal classification and diversity, Basic fungal morphology and life cycle | **10** | **1** |
| **Module 2** | **Hours** | |
| **Culinary Fungi:** Introduction to Culinary Fungi, Edible mushroom**,** Nutritional Value of Mushrooms, Preservation and Storage of Mushrooms, Gourmet mushrooms: cultivation, flavors, and culinary uses, Fungal delicacies from around the world, Foraging for Wild Mushrooms, Quorn | **20** | **1,2** |
| **Module 3** | **Hours** | |
| **Fungi in Fermented foods:** Health benefits of fermented food, Fermentation chemistry, Role of molds and yeasts in fermentation processes<br><br>**Biotechnological Applications of Fungi:** Industrial fermentation-production of enzymes, antibiotics, and biofuels, Bioremediation: fungal degradation of environmental pollutants, Fungi in biopharmaceuticals and drug discovery | **15** | **1, 2, 3,4** |

| | |
|---|---|
| **Mode of Transaction** | **Classroom activities:** Direct Instruction: Brainstorming lecture, Explicit Teaching, E-learning, interactive Instruction:, Active co-operative learning, Seminar, Group Assignments Authentic learning, , Library work and Group discussion, Presentation by individual student/ Group representative<br><br>**Field activities:**<br><br>**Lab based activities** |
| **Mode of Assessment** | **Continuous Internal Assessment (CIA)**<br><br>1. Internal Tests of maximum 20 marks<br><br>2. Seminar Presentation – a theme is to be discussed and identified to prepare a paper and present in the seminar - 10 mark<br><br>3. Write a detailed report on a given topic based on research findings-10 marks<br><br>Semester End examination – 60 marks |

## Learning Resources

1. Presscott/Harley/Klein's Microbiology - Joanne Willey, Linda Sherwood and ChrisWoolverton.

2. On Food and Cooking: The Science and Lore of the Kitchen by Harold McGee

| **Relevance of Learning the Course/ Employability of the Course** |
|---|
| The Course provides a multifaceted understanding of fungi, highlighting their importance in food science, medicine, industry, and environmental sustainability. |

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| | **MAHATMA GANDHI UNIVERSITY**<br>**Graduate School** |
| | **4 + 1 Integrated UG and PG Programme** |

| | | | |
|---|---|---|---|
| **School** | National Institute of Plant Science Technology (NIPST) | | |
| **Programme** | **M.Sc. Botany & Plant Science Technology** | | |
| **Course Title** | **Economic and Biotechnological Opportunities of Thallophyta** | | |
| **Course Type** | Minor | | |
| **Course Level** | 200-299 | | |
| **Course Code** | MG3DSCUBP221 | | |
| **Course Overview** | This is a foundational course for undergraduate students, covering the basics of plant science. It gives a general introduction to the way how the thallophytes are beneficial to mankind. The objective of the study is to understand how primitive plants are used as food, how they conserve the environments, improve and restore the atmospheric quality and helpful for human to lead a healthy life. | | |
| **Semester** | 3 | **Credit** | 4 |
| **Total Student Learning Time** | **Instructional hours for theory** | **Instructional hours for practical/lab work/field work** | |
| | 40 | 20 | |
| **Pre-requisite** | Basics of Biology in the 12th standard | | |

**COURSE OUTCOMES (CO)**

| CO No. | Expected Course Outcome | Learning Domains | PSO No. |
|---|---|---|---|
| | *Upon completion of this course, students will be able to :-* | | |
| 1 | **CO1:** Understand the diversity and its classification of thallophytes | R/U/An | 3, 4 |
| 2 | **CO2:** To impart knowledge on the habitat, habit structure, reproduction and life cycle of beneficial thallophytes | R/U | 1 |
| 3 | **CO3:** Identify the various economic opportunities provided by Thallophytes | U/An/A | 1,2 |

| | | | |
|---|---|---|---|
| 4 | **CO4:** Analyse how thallophytes and humans are interdependent | R/U/A | 5 |

*(Learning Domains: Remember (R ), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

**COURSE CONTENT**

| **Module 1 : Algae** | **Hours** | **CO No** |
|---|---|---|
| **Major Classes of Algae:** General Features of Major Classes, their habitat, habit, cell structure, reproduction & life cycle.<br>**Ecological and Economic Importance of Algae**. Productivity of fresh water and marine environment. - Algae in polluted habitat, Algal blooms, algal bioremediation – algae as ecological indicators. Algae as food, fodder, biofertilizer, medicine, industrial uses and fuel from algae. | 25 | 1 |
| **Module 2: Fungi** | | |
| **Introduction to Fungi:** Fungal classification and diversity, Basic fungal morphology and life cycle<br>**Fungi in Fermented foods:** Health benefits of fermented food, Fermented Fermentation chemistry, Role of molds and yeasts in fermentation processes | 15 | 2 |
| **Module 3: Bryophytes** | | |
| **Introduction to Bryophytes:** General classification of bryophytes, concept of algal and fungal origin of bryophytes, variations in thallus structure and reproduction. Fossil bryophytes.<br>**Ecology and Economic Importance of Bryophytes:** Water relations, adaptations, Role as pollution indicators, Bryophytes as medicine, food and fuel | 10 | 3 |
| **Module 4: Biotechnological Applications of Thallophytes** | | |
| Industrial and Biotechnological Applications of Algae: algal bioreactor, Biomass Production, lipid production, and other value-added products. Biodiesel / bio-oil production, Algae in wastewater treatment, Fungus: Industrial fermentation-production of enzymes, antibiotic, biopharmaceuticals and drug discovery, Bryophytes:Bryophytes as model organisms, Bryophytes in sustainable agricultural practices, Pharmaceutical and Cosmetic Applications | 10 | 4 |

| | |
|---|---|
| **Mode of Transaction** | **Classroom activities:** Direct Instruction: Brainstorming lecture, Explicit Teaching, E-learning, interactive Instruction: Active co-operative learning, Seminar, Group Assignments Authentic learning, Library work and Group discussion, Presentation by individual student/ Group representative<br><br>**Field & Lab based activities:** Identification and collection of thallophytes from the field |
| **Mode of Assessment** | 1. Internal Tests of maximum - 20 marks<br><br>2. Seminar Presentation – a theme is to be discussed and identified to prepare a paper and present in the seminar - 10 marks<br><br>3. Write a detailed report on a given topic based on research findings -10 marks<br><br>4. Semester End Examination – 60 marks |

**Learning Resources**


1. Schefield WB (1985) Introduction to Bryology, Mermilan Publishing Company. New York
2. Webster J and Weber R (2007) Introduction to Fungi, Cambridge University Press
3. Robert Edward Lee, 2008. Phycology. Cambridge University Press,
4. Shaw.J.A. and Goffinet B., 2000, Bryophyte Biology, Cambridge University Press.


| **Relevance of Learning the Course/ Employability of the Course** |
|---|
| '**Economic and Biotechnological Opportunities of Thallophyta**' helps the students to understand the wonderful world of Thallophyta and its significance in the Biosphere especially for the mankind. The topics covered in this course are relevant for a Biology programme at the undergraduate level. |

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| | **MAHATMA GANDHI UNIVERSITY**<br>**Graduate School** |
| | **4 + 1 Integrated UG and PG Programme** |

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|---|---|---|---|
| **School** | National Institute of Plant Science Technology (NIPST) | | |
| **Programme** | **4 +1 integrated UG and PG programme** | | |
| **Course Title** | Taming the Invaders: Strategies for Invasive Species Management | | |
| **Course Type** | MDC | | |
| **Course Level** | 200-299 | | |
| **Course Code** | MG3MDCUBP201 | | |
| **Course Overview** | This course provides a focused exploration of invasive species, emphasizing their identification, ecological impacts, and management strategies. Through three comprehensive modules, students will gain essential knowledge and practical skills needed for effective invasive species management. | | |
| **Semester** | 3 | **Credit** | 3 |
| **Total Student Learning Time** | **Instructional hours for theory** | **Instructional hours for practical/lab work/field work** | |
| | 45 | 0 | |
| **Pre-requisite** | Understanding of Environmental Science | | |

## COURSE OUTCOMES (CO)

| CO No. | Expected Course Outcome<br><br>*Upon completion of this course, students will be able to;* | Learning Domains | PSO No. |
|---|---|---|---|
| 1 | Identify key invasive species and understand their characteristics. | R/U | 1 |
| 2 | Analyze the ecological, economic, and social impacts of invasive species. | U/An | 1,3, 4 |
| 3 | Evaluate various management and control strategies for invasive species. | U/E | 1,3, 4 |
| 4 | Develop and implement a management plan for a specific invasive species. | C/A | 1,2,5 |
| 5 | Apply field techniques for monitoring and controlling invasive species | A/S | 2 |

*(Learning Domains: Remember (R ), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

**COURSE CONTENT**

| Module 1 | Hours | CO No |
|---|---|---|
| **Understanding Invasive Species:** Introduction and Definitions, Ecological and Economic Impacts, Overview of global and regional invasive species issues, Identification and Risk Assessment, Use of GIS and remote sensing in invasive species management | **10 hr** | 1,2 |
| **Module 2** | **Hours** | |
| **Management Strategies and Techniques:**Prevention and Early Detection, Control Methods: Mechanical and Physical Control Methods, Biological and chemical Methods, Integrated Pest Management (IPM), Developing and implementing an IPM plan | **20 hr** | 1,3,4 |
| **Module 3** | **Hours** | |
| **Practical Applications and Case Studies:** Restoration Ecology, Community Involvement and Education, Policy and Regulation, Real world examples | **15 hr** | 2, 4, 5 |

| | |
|---|---|
| **Mode of Transaction** | **Classroom activities:** Direct Instruction: Brainstorming lecture, Explicit Teaching, E-learning, interactive Instruction: Active cooperative learning, Seminar, Group Assignments Authentic learning, Library work and Group discussion, Presentation by individual student/ Group representative<br><br>**Field activities:**<br><br>**Lab based activities:** |
| **Mode of Assessment** | 1. Internal Tests of maximum 20 marks<br><br>2. Seminar Presentation – a theme is to be discussed and identified to prepare a paper and present in the seminar - 10 mark<br><br>3. Write a detailed report on a given topic based on research findings-10 marks<br><br>Semester End examination – 60 marks |

## Learning Resources


1. Simberloff, D. (2013). *Invasive Species: What Everyone Needs to Know*. Oxford University Press.
2. Mack, R. N., Simberloff, D., Lonsdale, W. M., Evans, H., Clout, M., & Bazzaz, F. A. (2000). *Biotic invasions: causes, epidemiology, global consequences, and control*. Ecological Applications.


| **Relevance of Learning the Course/ Employability of the Course** |
|---|
| Learning "Taming the Invaders: Strategies for Invasive Species Management" provides students with critical knowledge and skills to address the complex challenges posed by invasive species. The course enhances employability across various sectors by preparing students to tackle environmental, economic, and social issues related to invasive species management. Graduates are equipped to make meaningful contributions to biodiversity conservation, ecosystem health, and sustainable development efforts globally. |

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| | **MAHATMA GANDHI UNIVERSITY**<br><br>**Graduate School** |
| | **4 + 1 Integrated UG and PG Programme** |

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|---|---|---|---|
| **School** | National Institute of Plant Science Technology | | |
| **Programme** | **M.Sc. Botany and Plant Science Technology** | | |
| **Course Title** | **Cells in Bloom: Mastering the Techniques of Tissue Culture** | | |
| **Course Type** | VAC | | |
| **Course Level** | 200-299 | | |
| **Course Code** | MG3VACUBP201 | | |
| **Course Overview** | Understanding the basic techniques of plant tissue culture enhances the skill of students in performing basic tissue culture experiments, creating new protocols for the various objectives of plant tissue culture applications, and enables them to pursue a career in this field. This syllabus covers all the basic techniques of tissue culture experiments and general ideas about protocols, methods etc. | | |
| **Semester** | 3 | **Credit** | 3 |
| **Total Student Learning Time** | **Instructional hours for theory** | **Instructional hours for practical/lab work/field work** | |
| | 30 | 15 | |
| **Pre-requisite** | 12th standard biology stream | | |

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**COURSE OUTCOMES (CO)**

| CO No. | Expected Course Outcome<br><br>*Upon completion of this course, students will be able to;* | Learning Domains | PSO No. |
|---|---|---|---|
| 1 | Understand the general theory about plant tissue culture methods. | R, U | 1 |
| 2 | Analyse the different techniques involved in plant tissue culture | U, An | 2,3 |
| 3 | Develop skill in performing tissue culture experiments. | C,S | 3,5 |
| 4 | Develop novel ideas in applications of plant tissue culture leading to research | E, C | 4,5 |

*(Learning Domains: Remember (R ), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

**COURSE CONTENT**

| **Module 1 : Introduction to Plant Tissue Culture** | **Hours** | **CO No** |
|---|---|---|
| Basic principles of tissue culture: totipotency, callus, differentiation, dedifferentiation, redifferentiation.<br><br>Methods of sterilisation, Different types of culture media, Media preparation, Laboratory requirements and organisations, Tools and techniques | **15** | **1,2** |
| **Module 2: Culture Techniques** | **Hours** | |
| Explant- selection, maintenance, transfer, inoculation, incubation.<br><br>Callus culture, Cell suspension cultures, callus initiation, maintenance, organogenesis, morphogenesis | **10** | **2** |
| **Module 3: Plant propagation and Transformation** | **Hours** | |

| | | |
|---|---|---|
| Micropropagation, Somatic embryogenesis, Somaclonal Variation, Synthetic seed, Methods of gene transfer, Embryo rescue, Cryopreservation, Hardening<br>Organ culture, Protoplast culture, Meristem culture | **10** | **2,3** |
| **Module 4: Applications of Plant tissue culture** | **Hours** | |
| Transgenic plants for crop improvement, Commercial floriculture, Commercial horticulture, Secondary metabolite production | **10** | **3,4** |

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|---|---|
| **Mode of Transaction** | **Classroom activities:** Direct Instruction: Brainstorming lecture, Explicit Teaching, E-learning, interactive Instruction:, Active cooperative learning, Seminar, Group Assignments Authentic learning, Library work and Group discussion, Presentation by individual student/ Group representative<br>**Field activities:**<br>**Lab based activities:** Hands on training in plant tissue culture. |
| **Mode of Assessment** | 1. Internal Tests of maximum 20 marks<br>2. Seminar Presentation – a theme is to be discussed and identified to prepare a paper and present in the seminar - 10 mark<br>3. Write a detailed report on a given topic based on research findings-10 marks<br>Semester End examination – 60 marks |

## Learning Resources

1 Bhojwani SS (1983) Plant Tissue Culture: Theory and Practice. Elsevier

2 Dixon RA (2003) Plant Cell Culture, IRL Press.

3 White, P. R. (1943). *A handbook of plant tissue culture*. LWW.

| **Relevance of Learning the Course/ Employability of the Course** |
|---|
| Cells in Bloom: Mastering the Techniques of Tissue Culture not only provides essential skills in tissue culture techniques but also opens diverse career paths in biotechnology, agriculture, research, and entrepreneurial ventures. Graduates are equipped to contribute to scientific advancements, innovation in agriculture, and |

biotechnological breakthroughs, making them highly sought after in the global job market.

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| | **MAHATMA GANDHI UNIVERSITY**<br><br>**Graduate School** |
| | **4 + 1 Integrated UG and PG Programme** |

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|---|---|---|---|
| **School** | National Institute of Plant Science Technology (NIPST) | | |
| **Programme** | **M.Sc. Botany & Plant Science Technology** | | |
| **Course Title** | **An introduction to vascular cryptograms** | | |
| **Course Type** | Minor | | |
| **Course Level** | 200-299 | | |
| **Course Code** | MG4DSCUBP241 | | |
| **Course Overview** | This course is intended to introduce the morphology, anatomy, reproduction and life cycle of Pteridophytes, and Gymnosperms. Moreover study on fossil plants will help to unravel the evolutionary history of plant taxa. | | |
| **Semester** | 4 | **Credit** | 4 |
| **Total Student Learning Time** | **Instructional hours for theory** | **Instructional hours for practical/lab work/field work** | |
| | 45 | 15 | |
| **Pre-requisite** | Understanding of basic science | | |

## COURSE OUTCOMES (CO)

| CO No. | Expected Course Outcome<br><br>*Upon completion of this course, students will be able to;* | Learning Domains | PSO No. |
|---|---|---|---|
| 1 | **CO1:** Comprehensive knowledge in Pteridology, Gymnospersms and Paleobotany | R/U | |
| 2 | **CO2:** Acquire Laboratory skills | S/An | |
| 3 | **CO3:** Understand the ecological and economic importance pteridophytes and gymnosperms | U/An/A | |
| 4 | **CO4:** Student should be able to trace the evolution from fossil plants | R/U/A | |

*(Learning Domains: Remember (R ), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

**COURSE CONTENT**

| **Module 1** | **Hours** | **CO No** |
|---|---|---|
| **Pteridophytes:**<br>General characteristics, habitat, classification of pteridophytes<br>**Type study:**<br>Distribution, morphology, anatomy, reproduction and life cycle of the following types<br>Psilophyta-*Psilotum,* Lycophyta-*Lycopodium, selaginella,* Sphaenophyta-*Equisetum,* Pterophyta-*Pteris, Marsilea* | **25 hr** | 1,2 |
| **Module 2** | **Hours** | |
| Gymnosperms: General characteristics, Classification, and distribution of gymnosperms<br>**Type study:**<br>Distribution, morphology, anatomy, reproduction, life cycle of the following types<br>Cycadopsida-*Cycas*; Coniferopsida – *Pinus*; Gnetopsidae – *Gnetum*. | **20 hr** | 1,2 |
| **Module 3** | **Hours** | |

| | | |
|---|---|---|
| **Paleobotany:** Types of fossils, ideal conditions for fossilization, geological time scale.<br>Fossil pteridophytes: *Rhynia, Lepidodendron*<br>Fossil gymnosperms: *Glossopteris, Williamsonia* | **10 hr** | 4 |
| **Module 4** | **Hours** | |
| Ecological, economic, and evolutionary significance of pteridophytes and Gymnosperms. | **5 hr** | 3 |

| | |
|---|---|
| **Mode of Transaction** | **Classroom activities:** Direct Instruction: Brainstorming lecture, Explicit Teaching, E-learning, interactive Instruction:, Active co-operative learning, Seminar, Group Assignments Authentic learning, , Library work and Group discussion, Presentation by individual student/ Group representative<br>**Field activities:** Identification and collection of plant specimens from the field<br>**Lab based activities:** Study of the habit, TS of leaf and stem, morphology of reproductive structures of pteridophytes and gymnosperms |
| **Mode of Assessment** | **Continuous Internal Assessment (CIA)**<br>**1. Internal** Tests of maximum 20 marks<br>2. Seminar Presentation – a theme is to be discussed and identified to prepare a paper and present in the seminar Maximum marks 10<br>3. Write a detailed report on a given topic based on research findings-10 mark<br>**Semester End examination – 60 marks** |

## Learning Resources

1Chandra S, Srivastava M, 2003. Pteridology in New Millennium. Kluwer Academic Publishers.

2 Chamberlain C J, 1935. Gymnosperms: Structure and Evolution. Chicago University Press.

3 Taylor T N. Paleobotany: An Introduction to Fossil Plant Biology. Mc Graw Hill, New York.

| **Relevance of Learning the Course/ Employability of the Course** |
|---|
| |

Helps the students to understand and differentiate between the characteristics of Pteridophytes & Gymnosperms. Paleobotanical information will also unravel the evolutionary history of plant taxa, in both time and space.The topics covered in this course are relevant for a plant science programme at the undergraduate level.

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| | **MAHATMA GANDHI UNIVERSITY**<br>**Graduate School** |
| | **4 + 1 Integrated UG and PG Programme** |

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|---|---|---|---|
| **School** | National Institute of Plant Science Technology (NIPST) | | |
| **Programme** | **4 +1 integrated UG and PG programme** | | |
| **Course Title** | **Insights into Phytochemical Isolation** | | |
| **Course Type** | SEC | | |
| **Course Level** | 200-299 | | |
| **Course Code** | MG4SECUBP201 | | |
| **Course Overview** | This course explores the principles and practical techniques involved in the isolation and characterization of phytochemicals from plant sources. Students will gain hands-on experience in extraction methods, chromatographic techniques, and spectroscopic analysis used to identify and quantify bioactive compounds from plants. | | |
| **Semester** | 4 | **Credit** | 3 |
| **Total Student Learning Time** | **Instructional hours for theory** | **Instructional hours for practical/lab work/field work** | |

| | | |
|---|---|---|
| | 30 | 15 |
| **Pre-requisite** | Basic Chemistry Knowledge, Fundamental Biology Background | |

**COURSE OUTCOMES (CO)**

| CO No. | Expected Course Outcome<br>*Upon completion of this course, students will be able to;* | Learning Domains | PSO No. |
|---|---|---|---|
| 1 | Understanding of Phytochemical Isolation Techniques | R/U/A | |
| 2 | Proficiency in Analytical Methods | U/A | |
| 3 | Critical Analysis and Interpretation | U/An/E | |
| 4 | Ability to Apply Knowledge in Research and Industry | A/C | |

*(Learning Domains: Remember (R ), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

**COURSE CONTENT**

| **Module 1** | **Hours** | **CO No** |
|---|---|---|
| **Principles of Phytochemical Isolation:** Introduction to phytochemicals and their significance<br>Extraction techniques: solvent extraction, steam distillation, and Soxhlet extraction | **15** | **1,4** |
| **Module 2** | **Hours** | |
| **Chromatographic Techniques in Phytochemical Analysis:** Preparative chromatography: principles and application, Thin-layer chromatography (TLC) and column chromatography, High-performance liquid chromatography (HPLC): theory and applications, Gas chromatography-mass spectrometry (GC-MS): coupling and analysis | **20** | **1,2,4** |
| **Module 3** | **Hours** | |
| **Spectroscopic Analysis of Phytochemicals:** UV-Vis spectroscopy: application in phytochemical analysis, | **10** | **1,2,3,4** |

| | | |
|---|---|---|
| Infrared (IR) spectroscopy: principles and , applications, Nuclear magnetic resonance (NMR) spectroscopy: basics and interpretation | | |

| | |
|---|---|
| **Mode of Transaction** | **Classroom activities:** Direct Instruction: Brainstorming lecture, Explicit Teaching, E-learning, interactive Instruction:, Active cooperative learning, Seminar, Group Assignments Authentic learning, , Library work and Group discussion, Presentation by individual student/ Group representative<br><br>**Lab based activities:** Preparation of extracts of Herbs by successive solvent extraction methods to record the percentage yield, Detection of Phytoconstituents by chemical tests, Chromatographic methods (Paper, TLC and column) for separation of compounds from plant extract |
| **Mode of Assessment** | 1. Internal Tests of maximum 20 marks<br><br>2. Seminar Presentation – a theme is to be discussed and identified to prepare a paper and present in the seminar - 10 mark<br><br>3. Write a detailed report on a given topic based on research findings-10 marks<br><br>Semester End examination – 60 marks |

## Learning Resources

1.Houghton, P., & Raman, A. (2012). *Laboratory handbook for the fractionation of natural extracts*. Springer Science & Business Media.

2. Kumar, G. S., & Jayaveera, K. N. (2014). *A Textbook of Pharmacognosy and Phytochemistry*. S. Chand Publishing.

3. Upadhyay, A., Upadhyay, K., & Nath, N. (2003). Biophysical Chemistry Principles & Techniques Handbook.

| **Relevance of Learning the Course/ Employability of the Course** |
|---|
| This course equips students with essential skills to isolate and analyze phytochemicals, enabling them to contribute to fields such as pharmaceuticals, natural products chemistry, and nutraceuticals through informed research and development. |

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| | **MAHATMA GANDHI UNIVERSITY**<br><br>**Graduate School** |
| | **4 + 1 Integrated UG and PG Programme** |

| | | | |
|---|---|---|---|
| **School** | National Institute of Plant Science Technology (NIPST) | | |
| **Programme** | **M.Sc. Botany & Plant Science Technology** | | |
| **Course Title** | Horticulture and nursery management | | |
| **Course Type** | VAC | | |
| **Course Level** | 200-299 | | |
| **Course Code** | MG4VACUBP201 | | |
| **Course Overview** | This foundational course for undergraduate students offers a comprehensive introduction to horticulture and nursery management. This course is an applied science and knowledge gained by the students helps to improve plant production, marketing, and the quality of human life. | | |
| **Semester** | 4 | **Credit** | 3 |
| **Total Student Learning Time** | **Instructional hours for theory** | **Instructional hours for practical/lab work/field work** | |
| | 45 | 0 | |

| | |
|---|---|
| **Pre-requisite** | Understanding of basic science |

**COURSE OUTCOMES (CO)**

| CO No. | Expected Course Outcome<br>*Upon completion of this course, students will be able to;* | Learning Domains | PSO No. |
|---|---|---|---|
| 1 | **CO1:** Understand the significance of crop improvement and human welfare | R/U | |
| 2 | **CO2:** Understand plant propagation methods and become skilful | R/U/S | |
| 3 | **CO3:** Understand and inoculate interest in the nursery management strategies | U/An/A | |
| 4 | **CO4:** Analyse the impact of modern technologies on horticultural plants | R/U/An | |

*(Learning Domains: Remember (R ), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

**COURSE CONTENT**

| **Module 1** | **Hours** | **CO No** |
|---|---|---|
| **Introduction:** Definition, Importance and scope, branches of horticulture; Soil- Formation, composition, types, texture, pH and conductivity.<br>Principles of garden making: Pots and containers- Types of potting mixtures and potting media; lawn preparation, Common Garden tools and implements. | **15 hr** | 1 |
| **Module 2** | **Hours** | |
| Plant propagation methods: Sexual -Seed propagation Asexual- Cutting, layering, budding and grafting, Micropropagation; Transplantation and hardening of plants, manures and fertilizers, irrigation methods. | **10 hr** | 2 |
| **Module 3** | **Hours** | |

| | | |
|---|---|---|
| Nursery: definition, types; management strategies - planning, layout, budgeting - production unit, sales unit, nursery bed preparation; Nursery structures - greenhouses, fernery, orchidarium, abortorium. Pest management strategies | **10 hr** | 3 |
| **Module 4** | **Hours** | |
| Revolutionary technologies in horticulture: Artificial intelligence, The Internet of Things (IoT), Remote sensing, nuclear technology. Role of biotechnology in crop improvement. | **10 hr** | 4 |

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| **Mode of Transaction** | **Classroom activities:** Direct Instruction: Brainstorming lecture, Explicit Teaching, E-learning, interactive Instruction: Active co-operative learning, Seminar, Group Assignments Authentic learning, Library work and Group discussion, Presentation by individual student/ Group representative<br><br>**Field activities:**<br><br>**Lab based activities:** |
| **Mode of Assessment** | **Continuous Internal Assessment (CIA)**<br><br>1. **Internal** Tests of maximum 20 marks<br><br>2. Seminar Presentation – a theme is to be discussed and identified to prepare a paper and present in the seminar Maximum marks 10<br><br>3. Write a detailed report on a given topic based on research findings -10 mark<br><br>**Semester End examination – 60 marks** |

## Learning Resources

1 Adams C R, Early M P, 2004. Principles of Horticulture. Elsevier, N. Delhi.

2 Kumar N, 1994. Introduction to Horticulture. Rajalakshmi Pub. Nagarcoil

3 Sadhu M K, 1996. Plant Propagation. New age international publishers, N. Delhi

| **Relevance of Learning the Course/ Employability of the Course** |
|---|

Horticulture and proper nursery management plays a major role in the economy by generating employment, providing raw material to various food processing industries, and higher farm profitability due to higher production and export earnings from foreign exchange