

INDIRA GANDHI UNIVERSITY

Meerpur-Rewari (HR)



Scheme & Syllabus

of

MDC, VAC, SEC & VOC

for

Under-Graduate Programme

(Department of Botany)

**Under Multiple Entry-Exit, Internship and CBCS-LOCF in
accordance to NEP-2020 w.e.f. 2024-25 (in phased manner)**

Scheme of MDC, VAC, SEC and VOC

Semester	Scheme	Course Type & Total Credits	Course Code	Course Nomenclature	Credits	Hours/ week	Internal Assessment	End Term Marks	Maximum Marks	Exam Duration (hrs)		
Multidisciplinary Course (MDC)												
I	A, B, C & D	MDC-1 (3 Credits)	24L4.5-MDC-BOT-101	Fundamentals of Botany	T P	2 1	2 2	15 05	35 20	50 25	75 3	
II		MDC-2 (3 Credits)	24L4.5-MDC-BOT-201	Plants for Human Welfare	T P	2 1	2 2	15 05	35 20	50 25	75 3	
III		MDC-3 (3 Credits)	24L5.0-MDC-BOT-301	Ornamental Plants	T P	2 1	2 2	15 05	35 20	50 25	75 3	
Value Added Course (VAC)												
III		C	VAC-3 (2 Credits)	24L5.0-VAC-BOT-301	Ethnobotany	2	2	15	35	50	3	
IV		A & B C	VAC-3 (2 Credits) VAC-4 (2 Credits)	24L5.0-VAC-BOT-401	Basics of Medicinal Plants	2	2	15	35	50	3	
Skill Enhancement Course (SEC)												
II	A, B & C	SEC-2 (3 Credits)	24L4.5-SEC-BOT-201	Biofertilizers	T P	2 1	2 2	15 05	35 20	50 25	75 3	
		SEC-2 (3 Credits)	24L4.5-SEC-BOT-202	Vertical Farming	T P	2 1	2 2	15 05	35 20	50 25	75 3	
III		SEC-3 (3 Credits)	24L4.5-SEC-BOT-301	Plant Hybridization	T P	2 1	2 2	15 05	35 20	50 25	75 3	
VI		C	SEC-4 (2 Credits)	24L5.5-SEC-BOT-601	Olericulture	T P	1 1	1 2	10 05	20 15	30 20	50 3
Vocational Course (VOC)												
III		B	VOC-1 (4 Credits)	24L5.0-VOC-BOT-301	Organic Farming	T P	3 1	3 2	20 10	50 20	70 30	100 3
IV	A & C	VOC-1 (4 Credits)	24L5.0-VOC-BOT-401	Floriculture	T	3	3	20	50	70	100 3	
	B	VOC-2 (4 Credits)			P	1	2	10	20	30		100 4
	A & C	VOC-1 (4 Credits)	24L5.0-VOC-BOT-402	Nursery and Gardening	T	3	3	20	50	70	100 3	
	B	VOC-2 (4 Credits)			P	1	2	10	20	30		100 4
V	A & C	VOC-2 (4 Credits)	24L5.5-VOC-BOT-501	Organic Farming	T P	3 1	3 2	20 10	50 20	70 30	100 3	
VI	A, B & C	VOC-3 (4 Credits)	24L5.5-VOC-BOT-601	Mushroom Culture and Technology	T P	3 1	3 2	20 10	50 20	70 30	100 3	

Subject: Botany

Semester I (Session 2024-25)

Part A - Introduction

Course Type and Remarks	Course Code	Name of the Course	Credit		Contact Hours/ week	Internal Assessment	End Term Marks	Max. Marks	Exam Duration (hrs.)
MDC-1 (3 Credits) Scheme A, B, C & D	24L4.5-MDC-BOT-101	Fundamentals of Botany	T	2	2	15	35	50	3
			P	1	2	05	20	25	3

Level of the course (As per Annexure-I) – 100-199

Pre-Requisite for the course (if any):

Learning Objectives: Student will gain the knowledge about the practical aspects related to identification, structure, economic values of microorganisms, algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms.

Course Learning Outcomes (CLO): After completing this course, the learner will be able to

1. know general characteristics of microorganisms, algae, fungi, and lichens will be understandable to students.
2. acquire a conceptual grasp of bryophytes and pteridophytes.
3. attain knowledge about the fundamental features of gymnosperms.
4. acquire a foundational understanding of angiosperm morphology.
5. gain the knowledge about the practical aspects related to identification, structure, economic values of microorganisms, algae, fungi, bryophytes, pteridophytes gymnosperms, and angiosperms..

Part B - Contents of the Course

Instruction for Paper Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit.

Unit	Topics	Contact Hours
I	Diversity of Microbes and Mycology: General characteristics, morphology and economic importance of viruses, bacteria, fungi and lichens.	8
II	Algae, Bryophytes and Pteridophytes: General characteristics, morphology, economic and ecological importance.	7
III	Gymnosperms: General characteristics, morphology, economic and ecological importance.	7
IV	Angiosperms: General characteristics, morphology and economic importance.	8
V	Suggested Practical works	30

	Identification of some common algae and fungi. Morphological study of some common Bryophytes. Morphological study of some common Pteridophytes. Morphological study of some common Gymnosperms. Morphological study of some common Angiosperms. Note: Any other relevant practical can be offered. Excursion Report: Report on excursion tours with photographs, collection, preservation and preparation of herbarium sheets and specimens related to Archegoniates and Angiosperms. Mounting of a collected, properly dried and pressed specimen of minimum 10 wild plants with herbarium label.	
Suggested Evaluation Methods		
Internal Assessment		End Term Examination
➤ Theory ✓ Class Participation: 5 ✓ Seminar/ Presentation/ Assignment/ Quiz/ Class Test/ Peer-group discussion etc.: 5 ✓ Mid-Term Exam: 5 ➤ Practicum ✓ Class Participation: NA ✓ Seminar/ Demonstration/ Viva-voce/ Lab records etc.: 5 ✓ Mid-Term Exam: NA		➤ Theory ✓ Written Examination: 35 ➤ Practicum ✓ Practical Examination: 20
Part C - Recommended Books/ e-resources		
• Wiley, J.M., Sherwood, L.M. and Woolverton, C.J. (2019) Prescott's Microbiology. 11th Edn., McGraw Hill International. • Lee, R.E. (2018) Phycology. 5th Edn. Cambridge University Press. • Singh, V., Pande, P.C. and Jain D.K. (2017) Biodiversity (Microbiology, Fungi, Algae, Archegoniate: Bryophyta, Pteridophyta and Gymnosperms). Rastogi Publications. Meerut. • Aluwalia, A.S. (2020) Phycology: Principles, Processes and Applications. Daya Publishing House, New Delhi. • Dube, H.C. (2012) An Introduction to Fungi, Vikas Publishing House Pvt. Ltd., 4th Edn. Delhi. • Kumar, A., Vashishta, B. R. and Sinha, A. K. (2012) Bryophyta. Chand Publishing, New Delhi. • Lakhanpal, R.N., Maheshwari, H.K. and Awasthi N. (1976) A Catalogue of Indian Fossil Plants, Covering All Available Records from 1821 to 1970. Birbal Sahni Institute of Palaeobotany (Originally from the University of California). • https://www.mooc-list.com/tags/microbiologyhttps://microbiologyonline.org/file/7926d7789d8a2f7b2075109f68c3175e.pdf		

Subject: Botany
Semester II (Session 2024-25)

Part A - Introduction

Course Type and Remarks	Course Code	Name of the Course	Credit		Contact Hours/ week	Internal Assessment	End Term Marks	Max. Marks	Exam Duration (hrs.)
MDC-2 (3 Credits) Scheme A, B, C & D	24L4.5-MDC-BOT-201	Plants for Human Welfare	T	2	2	15	35	50	3
			P	1	2	05	20	25	3

Level of the course (As per Annexure-I) – 100-199

Pre-Requisite for the course (if any):

Learning Objectives: Students will acquire the knowledge about the economic valuable plants and their products

Course Learning Outcomes (CLO): After completing this course, the learner will be able to

1. acquire a foundational understanding of plant diversity.
2. develop a conceptual grasp of plants utilized for human welfare.
3. gain knowledge about the origins of certain cultivated plants.
4. acquire a conceptual understanding of the utilization of fruits, nuts, and other plant components for human welfare.

5. gain the knowledge about the practical aspects related to identification, structure, economic values of microorganisms, algae, fungi, bryophytes, pteridophytes gymnosperms, and angiosperms..

Part B - Contents of the Course

Instruction for Paper Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit.

Unit	Topics	Contact Hours
I	Understanding Biodiversity: Level of plant diversity in India, agrobiodiversity. Values and uses of Biodiversity. Role of plants in relation to Human Welfare.	8
II	Agroforestry: Economic and ecological Importance of agro and social forestry. Ornamental plants of India.	7
III	Crop Plants: Origin of cultivated plants, morphology and economic importance of food plants - Cereals (rice/ wheat and maize); Pulses - gram and pea.	7
IV	Fruits and Nuts: Important fruit crops and their commercial importance. Spices and condiments. Wood and its uses.	8
V	Suggested Practical works	30
	Identification and study of some important medicinal plants.	

Identification and study of some common ornamental plants. Identification and study of some important cereals. Identification and study of some important pulses. Identification and study of some important spice yielding plants. Study of different types of woods. Study of different fruit types. Note: Any other relevant practical can be offered.	
Excursion Report: Collection and classification of different plants useful for humans.	

Suggested Evaluation Methods

Internal Assessment	End Term Examination
➤ Theory ✓ Class Participation: 5 ✓ Seminar/ Presentation/ Assignment/ Quiz/ Class Test/ Peer-group discussion etc.: 5 ✓ Mid-Term Exam: 5 ➤ Practicum ✓ Class Participation: NA ✓ Seminar/ Demonstration/ Viva-voce/ Lab records etc.: 5 ✓ Mid-Term Exam: NA	➤ Theory ✓ Written Examination: 35 ➤ Practicum ✓ Practical Examination: 20

Part C - Recommended Books/ e-resources

• Singh, V., Pande, P.C. and Jain, D.K. (2018) Economic Botany, Rastogi Publications, Delhi. • Kocchar, S.L. (2016) Economic Botany: A Comprehensive Study, 5th Edn., Cambridge India. • Wickens, G.E. (2001) Economic Botany: Principles and Practices, Springer. • Daubenmire, R.F. (2017) Plants & Environment, 2nd Edn., John Wiley & Sons., New York. • Rajan. S.S. (2007) College Botany Vol-V, Part 1: Taxonomy and Economic Botany Himalaya Publishing House. • Mukharjee, S.K. (2004) College Botany Vol-III. New Central Book Agency, London. • https://www.bgci.org/files/Wuhan/PapersSustainable/Chen.pdf. • https://www.researchgate.net/publication/316861607_The_Role_of_Plants_in_Human_Welfare.
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Subject: Botany
Semester III (Session 2024-25)

Part A - Introduction	
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Course Type and Remarks	Course Code	Name of the Course	Credit		Contact Hours/ week	Internal Assessment	End Term Marks	Max. Marks	Exam Duration (hrs.)
MDC-3 (3 Credits)	24L5.0-MDC-BOT-301	Ornamental Plants	T	2	2	15	35	50	3
Scheme A, B, C & D			P	1	2	05	20	25	3

Level of the course (As per Annexure-I) –

Pre-Requisite for the course (if any):	
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Learning Objectives: The main objective of this course is to identify and classify a wide variety of ornamental plants based on their botanical characteristics.

Course Learning Outcomes (CLO): After completing this course, the learner will be able to

1. acquire an understanding of the history of gardens in India and other countries.
2. develop comprehensive knowledge about different groups of plants used as ornamentals.
3. learn about flower and seed production.
4. gain a deep understanding of vegetative propagation methods for ornamental plants.

5. learn various types of gardens and their significance, management, and methods of propagation of valuable plants.

Part B - Contents of the Course

Instruction for Paper Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit.

Unit	Topics	Contact Hours
I	Introduction: History of gardens in India; terrace gardening; popular gardens of India; Types of gardens (Formal and Informal gardens); Styles of gardens (Mughal gardens, French gardens, English gardens, Japanese gardens).	8
II	Significance of Ornamental Plants: Significance of shrubs, trees, palms, ferns, cycads, cacti and succulents, climbers, creepers, indoor plants, water plants, bonsai plants as ornamentals..	8
III	Production: Flower and seed production; protected cultivation of ornamentals; present position and scope of floriculture in India.	7
IV	Propagation Vegetative propagation-principles and practices of clone selection; techniques of cutting, budding, grafting and layering; propagation by specialized stems and roots.	7
V	Suggested Practical works	30

	• Preparation of nursery beds – flat, raised and sunken beds • Identification and description of various plants grown in ornamental gardens. • Tools, implements and containers used in ornamental gardening. • Planning, designing and establishment of garden features viz. lawn, hedge and edge, rockery etc. • To study propagation by separation and division technique. • Preparation of land for lawn and planting. • To study propagation by cuttings, layering, grafting and budding • Flower arrangement practices. • Preparation of bouquets, garland. Note: Any other relevant practical can be offered. Excursion Report: Report on excursion tours in nearby nursery to understand the ornamental plants diversity and breeding technique.	
Suggested Evaluation Methods		
Internal Assessment		End Term Examination
➤ Theory ✓ Class Participation: 5 ✓ Seminar/ Presentation/ Assignment/ Quiz/ Class Test/ Peer-group discussion, etc.: 5 ✓ Mid-Term Exam: 5 ➤ Practicum ✓ Class Participation: NA ✓ Seminar/ Demonstration/ Viva-voce/ Lab records, etc.: 5 ✓ Mid-Term Exam: NA		➤ Theory ✓ Written Examination: 35 ➤ Practicum ✓ Practical Examination: 20
Part C - Recommended Books/ e-resources		
• Singh, A.K. & Kumar A. 2023. Plant Propagation and Nursery management. S.K. Kataria and sons. • Arora, J.S. 2016. Introductory Ornamental Horticulture. Kalyani Publishers. 8th edition. • Sachdeva, P. & Tongbram, V. 2014. A Naturalist's guide to the trees & Shrubs of India. Prakash Books. • Jain, S.M. & Ochatt, S.J. 2009. Protocols for in vitro propagation of ornamental plants: 598 (Methods in Molecular Biology). Humana Press. • Sabina, GT and Peter KV. 2008. Ornamental Plants for Gardens. New India Publ. Agency. • Reddy S, Janakiram B, Balaji T, Kulkarni S & Misra RL. 2007. Hightech Floriculture. Indian Society of Ornamental Horticulture, New Delhi. • Bhattacharjee SK. 2006. Advances in Ornamental Horticulture. Vols. I-VI. Pointer Publ. • Krishnamurthy, K.V. 2004. An Advanced Text Book of Biodiversity - Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi. • https://www.isaaa.org/resources/publications/pocketk/foldable/Pocket%20K47%20(English).pdf. • https://www.encyclopedia.com/science/news-wires-white-papers-and-books/ornamental-plants. • https://www.flowersofindia.net.		

Syllabus of VAC

Subject: Botany Semester IV (Session 2024-25)

Part A - Introduction

Course Type and Remarks	Course Code	Name of the Course	Credit		Contact Hours/ week	Internal Assessment	End Term Marks	Max. Marks	Exam Duration (hrs.)
VAC-3 (2 Credits) Scheme C	24L5.0-VAC-BOT-301	Ethnobotany	T	2	2	15	35	50	3

Level of the course (As per Annexure-I) –

Pre-Requisite for the course (if any):

Learning Objectives: The main objective of this course is to gain a comprehensive understanding of the relationships between indigenous cultures and plant use, focusing on the identification, traditional knowledge, and conservation of ethnobotanically significant plants. Develop skills to document and analyze traditional plant use, explore the cultural importance of plants in various societies, and evaluate the implications of ethnobotanical research for biodiversity conservation and sustainable development

Course Learning Outcomes (CLO): After completing this course, the learner will be able to

1. understand the fundamental concepts and significance of ethnobotany in various indigenous cultures.
2. develop skills to document and analyze traditional plant use and cultural practices.
3. evaluate the role of ethnobotany in biodiversity conservation and sustainable development.
4. identify and categorize ethnobotanically significant plants and their applications in medicine, nutrition, and agricultures.

Part B - Contents of the Course

Instruction for Paper Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit.

Unit	Topics	Contact Hours
I	Introduction to Ethnobotany: Definition, scope and importance; history and development of ethnobotany. Ethnobotanical Methods: Fieldwork techniques - interviews, surveys, and participant observation; documentation and analysis of traditional knowledge.	7
II	Traditional Knowledge Systems: Overview of indigenous communities in Haryana; cultural practices and beliefs related to plant use. Applications of Ethnobotany: Examination and study of traditional healing and	8

	remedial plants, ritual plants, plants used for food and nutrition, traditional agricultural and crop management plants.	
III	Ethnobotanically Significant Plants in Haryana: Identification and uses of local medicinal, nutritional and ritual plants (Neem, Brahmi, Amla, Bael, Tulsi, Ashwagandha, Giloy, Mango, Aloe, Shankpushpi, Peepal, Banana, Arjun, etc. Biodiversity Conservation: Role of ethnobotany in conservation efforts; strategies for sustainable use of plant resources.	8
IV	Ethical Considerations: Intellectual property rights and benefit-sharing; ethical guidelines for conducting ethnobotanical research. Regulatory Frameworks: National and state-level policies on biodiversity and traditional knowledge; role of organizations in promoting and protecting ethnobotanical heritage.	7
Suggested Evaluation Methods		
Internal Assessment		End Term Examination
> Theory ✓ Class Participation: 5 ✓ Seminar/ Presentation/ Assignment/ Quiz/ Class Test/ Peergroup discussion etc.: 5 ✓ Mid-Term Exam: 5		> Theory ✓ Written Examination: 35
Part C - Recommended Books/ e-resources		
• Pieroni, A., & Quave, C.L. 2019. Ethnobotany: Principles and Applications. CABI Publishing. • Sofowora, A. 1993. Medicinal Plants and Traditional Medicine in Africa. Spectrum Books Ltd. • Schultes, R.E., & Reis, S.V. 1995. Ethnobotany: Evolution of a Discipline. Timber Press. • Green, J. 2000. The Herbal Medicine-Maker's Handbook: A Home Manual. Crossing Press. • Foster, S., & Duke, J.A. 2014. A Field Guide to Medicinal Plants and Herbs of Eastern and Central North America. Houghton Mifflin Harcourt. • https://botanicaldimensions.org/what-is-ethnobotany/ • https://bsi.gov.in/page/en/ethnobotany • https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7936095/		

Subject: Botany
Semester IV (Session 2024-25)

Part A - Introduction

Course Type and Remarks	Course Code	Name of the Course	Credit		Contact Hours/ week	Internal Assessment	End Term Marks	Max. Marks	Exam Duration (hrs.)
VAC-3 (2 Credits) Scheme A & B VAC-4 (2 Credits) Scheme C	24L5.0-VAC-BOT-401	Basics of Medicinal Plants	T	2	2	15	35	50	3

Level of the course (As per Annexure-I) –

Pre-Requisite for the course (if any):

Learning Objectives: The main objective of this course is to understand the fundamental principles of medicinal plants, including their identification, classification, cultivation, and therapeutic uses. Develop knowledge of the active compounds found in medicinal plants, their extraction methods, and applications in traditional and modern medicine.

Course Learning Outcomes (CLO): After completing this course, the learner will be able to

1. evaluate history and importance of medicinal plants at national and international level.
2. understand different systems of medicine and methods to extract active compounds as well as preparation of herbal remedies.
3. gain knowledge about medicinal plants and their parts used for herbal therapy.
4. acquaint with state and national level boards to manage conservation and sustainable use of medicinal plants.

Part B - Contents of the Course

Instruction for Paper Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit.

Unit	Topics	Contact Hours
I	Introduction to Medicinal Plants: History, importance and prospects of medicinal plants; past and present status in the world and India. Medicinal Plant Diversity and Traditional Medicine: Medicinal plant diversity and local healthcare; concept and principles of Ayurveda, Siddha, Unani, and Homeopathy.	7

II	Phytochemistry of Medicinal Plants: Overview of active compounds; role of these compounds in plant defense and human health. Extraction and Herbal Remedies: Methods of extraction - polar and non-polar extraction, extraction of essential oils; types of herbal remedies - maceration, infusion, decoction, tinctures, compress, bathing, pills, ointments.	8
III	Important Medicinal Plants of India: Uses of <i>Oscimum</i> , <i>Azadirachta</i> , <i>Rawolfia</i> , <i>Vinca rosea</i> , <i>Justicia adhatoda</i> , <i>Terminalia</i> , <i>Aloe vera</i> , <i>Withania somnifera</i> . Therapeutic Applications: Herbal industries and their significance; uses of medicinal plants in treating common ailments.	8
IV	Cultivation and Conservation: Selection of suitable species for cultivation; IPR in the context of medicinal plants. Regulation, Promotion, and Intellectual Property: Objectives and functions of National Medicinal Plant Board and State Medicinal Plant Boards	7
Suggested Evaluation Methods		
Internal Assessment		End Term Examination
➤ Theory ✓ Class Participation: 5 ✓ Seminar/ Presentation/ Assignment/ Quiz/ Class Test/ Peergroup discussion etc.: 5 ✓ Mid-Term Exam: 5		➤ Theory ✓ Written Examination: 35
Part C - Recommended Books/ e-resources		
• Van Wyk, B.-E., & Wink, M. (2015). Medicinal Plants of the World: An Illustrated Scientific Guide to Important Medicinal Plants and Their Uses. Timber Press. • Sofowora, A. (1993). Medicinal Plants and Traditional Medicine in Africa. Spectrum Books Ltd. □ Green, J. (2000). The Herbal Medicine-Maker's Handbook: A Home Manual. Crossing Press. • Foster, S., & Duke, J. A. (2014). A Field Guide to Medicinal Plants and Herbs of Eastern and Central North America. Houghton Mifflin Harcourt. • https://www.urmc.rochester.edu/encyclopedia/content.aspx?contenttypeid=1&contentid=1169 □ • https://nmpb.nic.in/ • https://www.dabur.com/ayurveda/ayurvedic-medicinal-plants		

Syllabus of SEC

Subject: Botany

Semester II (Session 2024-25)

Part A - Introduction

Course Type And Remarks	Course Code	Name of the Course	Credit		Contact Hours/ week	Internal Assessment	End Term Marks	Max. Marks	Exam Duration (hrs.)
SEC-2 (3 Credits) Scheme A, B & C	24L4.5- SEC- BOT-201	Biofertilizers	T	2	2	15	35	50	3
			P	1	2	5	20	25	3

Level of the course (As per Annexure-I) –

Pre-Requisite for the course (if any):

Learning Objectives: The main objective of this course is to understand biofertilizers' role, types, benefits, production, application and impact on soil, crops and environment.

Course Learning Outcomes (CLO): After completing this course, the learner will be able to

1. understand the role of biofertilizers in enhancing soil fertility and plant nutrition.
2. learn about the different types of biofertilizers and their modes of action.
3. explore the benefits and challenges of using biofertilizers compared to chemical fertilizers.
4. gain knowledge of biofertilizer production, application methods and storage.
5. isolate the microorganisms involved in biofertilizers and preparation of various types of composts.

Part B - Contents of the Course

Instruction for Paper Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit.

Unit	Topics	Contact Hours
I	General Overview of Biofertilizers: Definition and their role in sustainable agriculture; significance of biofertilizers in improving soil health and crop productivity. Types of Biofertilizers: Nitrogen-fixing biofertilizers (<i>Rhizobium</i> , <i>Azospirillum</i> , <i>Azotobacter</i>); Phosphorus-solubilizing biofertilizers (Phosphate-solubilizing bacteria, Mycorrhizae).	8
II	Rhizobium and Actinomycetes as Biofertilizers: Isolation, identification and mass multiplication of <i>Rhizobium</i> . Actinomycetes in soil fertility improvement and nitrogen fixation. Azospirillum and Cyanobacteria as Biofertilizers: Isolation, mass multiplication, and application of <i>Azospirillum</i> . Role of Cyanobacteria (blue-green algae) in nitrogen fixation and soil enrichment.	8

III	Mycorrhizal Association: Types, occurrence, distribution, isolation, significance and colonization of Vesicular Arbuscular Mycorrhizae (VAM). Antagonistic Bacteria and Fungi: Role and application of antagonistic microorganisms in disease suppression and plant health.	7
IV	Organic Farming Practices: Green manuring, organic fertilizers, and their role in soil health and nutrient cycling. Waste Recycling and Sustainable Practices: Recycling of biodegradable wastes in bio-compost, field application and benefits of vermicompost.	7
V	Suggested Practical works - Isolation of microbes used as biofertilizers from soil. - Study of Rhizobium from root nodules of leguminous plants by Gram staining method. - Test for pH, CI and organic matter of different composts. - Observation of mycorrhizae from roots and production of VAM by pot culture. - Methods of sterilization, media preparation and inoculation of microbes. - Isolation of arbuscular mycorrhizal spores from rhizospheric soil. - Spots, Specimen /photographs of earthworm, <i>Azolla</i>, arbuscules vesicles. - Projects on any topic mentioned in the syllabus, with Rhizobium technology, AMF technology, organic farming, vermicomposting, bio compost, <i>Azolla</i> culture. Note: Any other relevant practical can be offered. Excursion Report: Report on excursion tours in nearby nursery or agriculture farm to understand the impact of biofertilizers.	30
Suggested Evaluation Methods		
Internal Assessment		End Term Examination
➤ Theory ✓ Class Participation: 5 ✓ Seminar/ Presentation/ Assignment/ Quiz/ Class Test/ Peer-group discussion, etc.: 5 ✓ Mid-Term Exam: 5 ➤ Practicum ✓ Class Participation: NA ✓ Seminar/ Demonstration/ Viva-voce/ Lab records, etc.: 5 ✓ Mid-Term Exam: NA		➤ Theory ✓ Written Examination: 35 ➤ Practicum ✓ Practical Examination: 20
Part C - Recommended Books/ e-resources		
- Kalamkar, P.B. and Padole, B.D. (2020). Biofertilizers: A Sustainable Eco-friendly Agricultural Approach. Springer. - Singh, D.P. and Singh, H.B. (Eds.). (2019). Biofertilizers for Sustainable Agriculture and Environment. CRC Press. - Mukerji, K.G., Keswani, C. and Singh, D.P. (2014). Biofertilizers and Organic Fertilizers: A Handbook for Sustainable Agriculture. Springer. - Arora, N.K. (2019). Biofertilizers: An Alternative Source of Plant Nutrients. Springer.		

- <https://vikaspedia.in/agriculture/agri-inputs/bio-inputs/bioinputs-for-nutrient-management/biofertilizers>
- <https://www.peptechbio.com/blog-biofertilizers/>
- <https://aicrp.icar.gov.in/biofertilizers/>

Subject: Botany									
Semester II (Session 2024-25)									
Part A - Introduction									
Course Type and Remarks	Course Code	Name of the Course	Credit		Contact Hours/ week	Internal Assessment	End Term Marks	Max. Marks	Exam Duration (hrs.)
SEC-2 (3 Credits) Scheme A, B & C	24L4.5- SEC- BOT-202	Vertical Farming	T	2	2	15	35	50	3
			P	1	2	5	20	25	3
Level of the course (As per Annexure-I) –									
Pre-Requisite for the course (if any):									
Learning Objectives: The main objective of this course is to understand the principles, techniques, and benefits of vertical farming for sustainable agriculture and food production.									
Course Learning Outcomes (CLO): After completing this course, the learner will be able to									
1. understand the principles and concepts of vertical farming systems such as such as hydroponics, aeroponics and aquaponics.									
2. learn how to select suitable crops for vertical farming and understand best practices for their cultivation.									
3. gain knowledge about the principles of designing and planning a vertical farm.									
4. explore the economic aspects of vertical farming, including business models, market trends, and the financial viability of vertical farming.									
5. gain the knowledge and hand on experience in growing plants under various conditions and systems of vertical farming.									
Part B - Contents of the Course									
Instruction for Paper Setter									
1. Nine questions will be set in all. All questions will carry equal marks.									
2. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit.									
Unit	Topics								Contact Hours
I	Concept and Significance: Definition, history and evolution of vertical farming; vertical farms in India and world; importance and potential benefits of vertical farming in sustainable agriculture. Vertical Farm Design and Structures: Components, layout and working principles of vertical farms; media, substrates, and growing systems used in vertical farming.								8
II	Hydroponics and Aeroponics: Principles, types and applications of hydroponics in vertical farming; advantages, challenges and innovations in aeroponics for vertical farming. Crop Propagation and Selection: Sexual and asexual propagation techniques in vertical farming; selection of suitable crops, cultivars and varieties for vertical farming systems.								8

III	Environmental Benefits: Resource efficiency: Water usage, land conservation, and energy optimization; environmental impact reduction, biodiversity preservation and climate change resilience. Economic Viability and Opportunities: Cost analysis, profitability, and economic sustainability of vertical farming; job creation, entrepreneurship and market opportunities in vertical farming industry.	7
IV	Sustainability Challenges: Sustainable practices, waste management, and ecological balance in vertical farming; regulatory compliance, standards and certifications for sustainable vertical farming. Innovation and Future Trends: Technological advancements, automation and smart farming in vertical agriculture; future prospects, emerging trends and global impact of vertical farming.	7
V	Suggested Practical works • To grow plants under hydroponics and aeroponics • Compare the rate of growth and vigor of hydroponically grown plants (under nutrient-rich and nutrient-deficient water conditions). • To study the aquaponics system in reference to simultaneously grown plants and fish in the same system • To study sustainable farming techniques for urban areas. • Compare the rate of growth and vigor of aeroponically grown plants • To study the wind-powered vertical farming tower. Note: Any other relevant practical can be offered. Excursion Report: Report on excursion tours in nearby vertical farming site.	30
Suggested Evaluation Methods		
Internal Assessment		End Term Examination
➤ Theory ✓ Class Participation: 5 ✓ Seminar/ Presentation/ Assignment/ Quiz/ Class Test/ Peer-group discussion, etc.: 5 ✓ Mid-Term Exam: 5 ➤ Practicum ✓ Class Participation: NA ✓ Seminar/ Demonstration/ Viva-voce/ Lab records, etc.: 5 ✓ Mid-Term Exam: NA		➤ Theory ✓ Written Examination: 35 ➤ Practicum ✓ Practical Examination: 20
Part C - Recommended Books/ e-resources		
• Despommier, D. (2010). The Vertical Farm: Feeding the World in the 21st Century. St. Martin's Griffin. • Godfrey, A. and Godfrey, B. (2016). Vertical Farming: A Beginner's Guide. Independently published. • Dickson, M. (2019). Hydroponics and Vertical Farming: The Future of Food. New Society Publishers. • Misra, R.L. and Misra S. (2017). Soilless Crop production. Daya Publishing House. • https://www.cropin.com/vertical-farming • https://www.edengreen.com/blog-collection/what-is-vertical-farming • https://www.jains.com/JainGreenhouse/Vertical%20Farming.htm		

Subject: Botany

Semester III (Session 2024-25)

Part A - Introduction

Course Type and Remarks	Course Code	Name of the Course	Credit		Contact Hours/ week	Internal Assessment	End Term Marks	Max. Marks	Exam Duration (hrs.)
SEC-3 (3 Credits) Scheme A, B & C	24L4.5- SEC- BOT-301	Plant Hybridization	T	2	2	15	35	50	3
			P	1	2	5	20	25	3

Level of the course (As per Annexure-I) –

Pre-Requisite for the course (if any):

Learning Objectives: The main objective of this course is to understand plant hybridization principles and techniques for crop improvement in agriculture. Appreciate the historical and contemporary significance of plant hybridization in food security and biodiversity conservation.

Course Learning Outcomes (CLO): After completing this course, the learner will be able to

1. understand the concept of plant hybridization and its importance in crop improvement.
2. learn e different methods of plant hybridization, including natural and artificial techniques.
3. explore the principles of inheritance and genetic variation in hybrid plants.
4. gain knowledge of hybridization techniques used in breeding programs to develop new crop varieties with desired traits.
5. gain knowledge about the floral structures and underlying plant breeding techniques.

Part B - Contents of the Course

Instruction for Paper Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit.

Unit	Topics	Contact Hours
I	General Objectives of Plant Breeding: Major achievements and future prospects in plant breeding. Genetic Mechanisms in Plant Breeding: Introduction, classification and utilization of self-incompatibility in breeding. Basics of population genetics and Hardy-Weinberg law.	8
II	Heterosis and Hybrid Vigor: Concept, effects, estimation, genetic basis and theories of heterosis. Hybridization Techniques: Types and steps in hybridization programs; choice of parents, emasculation methods, pollination and harvesting of F1 seeds.	8
III	Wide Hybridization: Definition, types, examples and achievements; techniques for overcoming incompatibility barriers.	7

	Breeding Methods in Self-Pollinated and Cross-Pollinated Crops: Pure line selection, mass selection, pedigree method and bulk method; list of plant breeding methods for cross-pollinated crops.		
IV	Recurrent Selection: Types of recurrent selection and its procedure. Evaluation of Breeding Methods: Criteria for evaluating breeding methods; application of breeding methods in crop improvement and trait enhancement.	7	
V	Suggested Practical works	30	
	• Study of floral structure of self- pollinated crops. • Study of floral structure of cross pollinated crops. • Emasculation methods: hand, hot water, cold water, alcohol, suction, chemical emasculation • Designs used in plant breeding experiment • Study of male sterility system • To test pollen viability/incompatibility Note: Any other relevant practical can be offered. Excursion Report: Report on excursion tours in nearby nursery to understand the breeding technique.		
Suggested Evaluation Methods			
Internal Assessment			End Term Examination
➤ Theory ✓ Class Participation: 5 ✓ Seminar/ Presentation/ Assignment/ Quiz/ Class Test/ Peer-group discussion, etc.: 5 ✓ Mid-Term Exam: 5 ➤ Practicum ✓ Class Participation: NA ✓ Seminar/ Demonstration/ Viva-voce/ Lab records, etc.: 5 ✓ Mid-Term Exam: NA		➤ Theory ✓ Written Examination: 35 ➤ Practicum ✓ Practical Examination: 20	
Part C - Recommended Books/ e-resources			
• Mendel, G. (1865). Experiments in Plant Hybridization. Johann Gregor Mendel Publishing. • Jain, H. K. (1996). Principles of Plant Breeding. CRC Press. • Poehlman, J. M. and Sleper, D. A. (1995). Breeding Field Crops. Blackwell Publishing. • Acquaah, G. (2012). Principles of Plant Genetics and Breeding. John Wiley & Sons. • https://www.britannica.com/science/plant-breeding/Hybrid-varieties • https://pubmed.ncbi.nlm.nih.gov/33862960/ • https://nph.onlinelibrary.wiley.com/doi/pdf/10.1046/j.1469-8137.1998.00315.x			

Subject: Botany**Semester VI (Session 2024-25)****Part A - Introduction**

Course Type and Remarks	Course Code	Name of the Course	Credit		Contact Hours/ week	Internal Assessment	End Term Marks	Max. Marks	Exam Duration (hrs.)
SEC-4 (2 Credits) Scheme C	24L5.5- SEC- BOT-601	Olericulture	T	1	1	10	20	30	3
			P	1	2	05	15	20	3

Level of the course (As per Annexure-I) –**Pre-Requisite for the course (if any):**

Learning Objectives: The main objective of this course is to understand the principles and practices of vegetable cultivation, including crop selection, planting, management, and harvesting techniques.

Course Learning Outcomes (CLO): After completing this course, the learner will be able to

1. Distinguish the growing of vegetables according to season and climate.
2. understand and explain the special intercultural operations done in vegetable crops.
3. Identify the diseases and pests of vegetable crops and their management.
4. gain knowledge for morphology and taxonomy of different vegetable crops.
5. grow and produce various types of vegetables and understanding of package and practices of vegetable crops.

Part B - Contents of the Course**Instruction for Paper Setter**

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit.

Unit	Topics	Contact Hours
I	Importance and Potential: Importance of vegetable cultivation in India and Haryana. Export and import potential of vegetables in India. Challenges and Solutions: Constraints in vegetable production, remedies to overcome production challenges	8
II	Cultivation of Solanaceous Vegetables- Brinjal: Importance, morphology, taxonomy, varieties, climate, seeds and sowing, manuring, irrigation and harvesting. Diseases and their control. Tomato: Importance, morphology, taxonomy, varieties, climate, seeds and sowing, manuring, irrigation and harvesting. Diseases and their control.	8
III	Cultivation of Leafy and Root Vegetables- Coriander and Spinach: Importance, morphology, taxonomy, varieties, climate, seeds and sowing, manuring, irrigation and harvesting. Diseases and their control.	7

	Carrot and Beetroot: Importance, morphology, taxonomy, varieties, climate, seeds and sowing, manuring, irrigation and harvesting. Diseases and their control.	
IV	Cultivation of Leguminous Vegetables- Mung Bean: Importance, morphology, taxonomy, varieties, climate, seeds and sowing, manuring, irrigation and harvesting. Diseases and their control. Chickpea: Importance, morphology, taxonomy, varieties, climate, seeds and sowing, manuring, irrigation and harvesting. Diseases and their control.	7
V	Suggested Practical works	
	• Demonstration of seed germination test for a vegetable seed and seed viability test. • Identification of vegetable seeds and vegetable crops at different growth stages. • Preparing vegetable nursery beds. • Raising vegetable seedlings in nursery bed and portrays. • Land preparation for sowing/ transplanting of vegetable crops. • Sowing/ transplanting of vegetables in main field. • Fertilizer application for vegetable growing. • Irrigation practices in a vegetable crop field. Note: Any other relevant practical can be offered. Excursion Report: Report on vegetable crops in a locality. Collection and preparation of herbarium of vegetable crops in their locality.	30
Suggested Evaluation Methods		
Internal Assessment		End Term Examination
➤ Theory ✓ Class Participation: 5 ✓ Seminar/ Presentation/ Assignment/ Quiz/ Class Test/ Peer-group discussion, etc.: 5 ✓ Mid-Term Exam: 5 ➤ Practicum ✓ Class Participation: NA ✓ Seminar/ Demonstration/ Viva-voce/ Lab records, etc.: 5 ✓ Mid-Term Exam: NA		➤ Theory ✓ Written Examination: 35 ➤ Practicum ✓ Practical Examination: 20
Part C - Recommended Books/ e-resources		
• Bose, T.K., Som, M.G. and Kabir, J. (1986). Vegetable Crops in India. Naya Prokash. • Chadha, K.L. (2001). Handbook of Horticulture. Indian Council of Agricultural Research (ICAR). • Rubatzky, V.E. and Yamaguchi, M. (1997). World Vegetables: Principles, Production, and Nutritive Values. Springer. • Nonnecke, I.L. (1989). Vegetable Production. Springer. • Singh, H.P., Singh, N.P. and Deka, B.C. (2004). Vegetable Production Technology. Westville Publishing House. • https://www.gardeningknowhow.com/edible/vegetables/vgen/science-of-vegetable-growing.htm • https://www.britannica.com/science/horticulture#ref410749 • http://eagri.org/eagri50/HORT281/pdf/lec01.pdf		

Subject: Botany
Semester III (Session 2024-25)

Part A - Introduction

Course Type and Remarks	Course Code	Name of the Course	Credit		Contact Hours/ week	Internal Assessment	End Term Marks	Max. Marks	Exam Duration (hrs.)
VOC-1 (4 Credits)	24L5.0-VOC-BOT-301	Organic Farming	T	3	3	20	50	70	3
Scheme B			P	1	2	10	20	30	3

Level of the course (As per Annexure-I) –

Pre-Requisite for the course (if any):

Learning Objectives: The main objective of this course is to gain a comprehensive understanding of the principles and practices of organic farming, including soil health management, pest and disease control, and sustainable crop production methods.

Course Learning Outcomes (CLO): After completing this course, the learner will be able to

1. understand the need and concept of organic and integrated farming system.
2. develop a conceptual understanding of plant nutrients, utilization of biofertilizers.
3. gain knowledge about the disease and pest management.
4. learn about the use of plant products in organic farming, quality control and certification procedures of organic products.
5. gain the knowledge of practical aspects of organic and integrated farming system, role of nutrient in plant growth, utilization of plant and animal waste in organic farming, and also learn about the standardization procedures.

Part B - Contents of the Course

Instruction for Paper Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit.

Unit	Topics	Contact Hours
I	Basics of Organic Farming and Management: History, importance, concept and principle, advantages and disadvantages, status of organic farming in India, developing organic farms. Organic Certification and Standards: Certification process for organic farms, National and international standards (IFOAM, USDA Organic, India Organic).	11
II	Soil Health: Importance of soil health and soil fertility management (use of farm yard manure/ rural compost, mulching, city compost, animal wastes, vermicomposts, green manures, biofertilizers, etc.). Plant nutrients and Crop Management: Essential plant nutrients, their role in plant	12

	growth and development, nutrient management (NPK) in organic farming; selection of crops suitable for organic farming, planting, harvesting and crop rotation strategies. Organic agri- horticulture in urban & semi urban areas.	
III	Pest and Disease Management: Integrated pest managements (IPM), seed, seedling and soil treatment measures; biological control agents viz. beneficial insects, nematodes and microorganisms, organic pesticides and natural remedies; advantage over chemical pesticides. Weed Management: Cultural and mechanical weed control methods, use of cover crops and mulches, biological weed control options.	11
IV	Sustainable Practices and Innovations: Efficient irrigation techniques: drip, sprinkler, and rainwater harvesting, managing water quality for organic farming, waste management and recycling practices. Marketing and Socio-Economic Aspects: Market trends and consumer demand for organic products; branding, labeling and value addition; financial planning and risk management; Social benefits of organic farming: rural development, food security.	11
V	Suggested Practical works	
	• Preparation of compost by open air composting. • Preparation of vermicompost. • Determining the effectiveness of neem extract in pest control. • Comparative analysis of plants grown in the presence of organic and inorganic fertilizers. • Comparative analysis of nitrogen content in organic and inorganic fertilizers. • Comparative analysis of phosphorous content in organic and inorganic fertilizers. Note: Any other relevant practical can be offered. Excursion Report: Report on excursion tours in nearby organic farms.	30
Suggested Evaluation Methods		
Internal Assessment		End Term Examination
➤ Theory ✓ Class Participation: 5 ✓ Seminar/ Presentation/ Assignment/ Quiz/ Class Test/ Peer-group discussion etc.: 5 ✓ Mid-Term Exam: 10 ➤ Practicum ✓ Class Participation: NA ✓ Seminar/ Demonstration/ Viva-voce/ Lab records etc.: 10 ✓ Mid-Term Exam: NA		➤ Theory ✓ Written Examination: 50 ➤ Practicum ✓ Practical Examination: 20
Part C - Recommended Books/ e-resources		
• Chandran, S., Unni M.R., Thomas, S. Meena, D.K. 2023. Organic Farming: Global Perspectives and Methods. Elsevier. • Somasundaram, E. Udhaya Nandhini, D., Meyyappan, M. 2021. Principles of Organic Farming. CRC Press. • Chandran, S., Thomas, S., Unni M.R. 2019. Organic Farming: New Advances Towards Sustainable		

Agricultural Systems. Springer.

- Giri b, Prasad, R. Qiang-Sheng, W. & Varma A. 2019. Biofertilizers for sustainable agriculture and environment (Soil Biology Book 55). Springer.
- Chandran, S., Unni M.R., Thomas, S. 2018. Organic Farming: Global Perspectives and Methods. Elsevier.
- Subbarao, N.S. 2017. Bio-fertilizers in Agriculture and Forestry. MedTech Publishers. 4th Edn.
- Hermary, H. 2007. Working with nature. Gaia College Inc.
- <https://ofrf.org/>
- <https://nconf.dac.gov.in/>
- <https://elearn.nptel.ac.in/shop/nptel/organic-farming-for-sustainable-agricultural-production/?v=c86ee0d9d7ed>

Subject: Botany**Semester IV (Session 2024-25)****Part A - Introduction**

Course Type and Remarks	Course Code	Name of the Course	Credit		Contact Hours/ week	Internal Assessment	End Term Marks	Max. Marks	Exam Duration (hrs.)
VOC-1 (4 Credits) Scheme A & C	24L5.0- VOC- BOT-401	Floriculture	T	3	3	20	50	70	3
VOC-2 (4 Credits) Scheme B			P	1	2	10	20	30	3

Level of the course (As per Annexure-I) –**Pre-Requisite for the course (if any):**

Learning Objectives: The main objective of this course is to develop the skills and knowledge necessary to effectively cultivate and manage ornamental plants, including understanding plant propagation, soil and nutrient management, pest and disease control, and design and maintenance of floral arrangements and landscapes.

Course Learning Outcomes (CLO): After completing this course, the learner will be able to

1. understand the importance and scope of floriculture, management of nursery and gardens, methods of plant propagation.
2. develop a conceptual understanding of different types of ornamental plants.
3. gain knowledge about the various types of gardens and importance of landscaping.
4. learn about commercial floriculture and cultivation of important cut flowers.
5. gain the knowledge of practical aspects of floriculture, management of nursery, maintenance of gardens, vase life of cut flowers, various methods used for the propagation of ornamental plants, hydroponics, and disease management.

Part B - Contents of the Course**Instruction for Paper Setter**

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit.

Unit	Topics	Contact Hours
I	Introduction to Floriculture: History, importance and scope of floriculture and landscape gardening, overview of the floriculture industry and its economic significance, current trends and status in India. Nursery Management and Routine Garden Operations: Establishing and managing nurseries; sexual and vegetative methods of plant propagation; soil sterilization techniques; seed sowing, pricking, planting, and transplanting.	11

II	Cultivation of Ornamental Plants: Flowering annuals and herbaceous perennials, shade and ornamental trees, divine vines, ornamental bulbous and foliage plants, cacti, and succulents, palms, cycads, ferns and selaginellas. Indoor Gardening and Special Techniques: Cultivation of plants in pots and containers, indoor gardening practices, Bonsai- techniques, and maintenance. Use of plant growth regulators in ornamental plant cultivation.	11
III	Garden Design Technique: Elements and principles of garden design. English, Italian, French, Persian, Mughal, and Japanese garden styles; Design features - garden walls, fencing, hedges, lawns, flower beds, shrubbery and water gardens. Landscaping for Public Spaces: Landscaping highways, parks, and educational institutions; functional landscape design for public spaces; ecological and sustainable landscaping practices.	11
IV	Commercial Floriculture Practices: Factors affecting flower production; production, packaging and marketing of cut flowers; post-harvest handling, flower arrangements and methods to prolong vase life. Cultivation practices for important cut flowers- Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolus, Marigold, Rose, Lilium. Diseases and Pests of Ornamental Plants: Identification and management of common diseases and pests affecting ornamental plants, Integrated pest management strategies.	12
V	Suggested Practical works • Plant propagation by cutting. • Plant propagation by grafting. • Plant propagation by air-layering. • Investigating the effect of different flower preservatives on the vase life of common ornamental flowers. • Setting up a laboratory scale hydroponics setup. • Preparation of different types of floral arrangements. • Morpho-anatomical study of different types of flowers. • Study of different diseases in ornamental plants. Note: Any other relevant practical can be offered. Excursion Report: Report on excursion tours in nearby park or garden to recognize the seasonal ornamental crops.	30
Suggested Evaluation Methods		
Internal Assessment		End Term Examination
➤ Theory ✓ Class Participation: 5 ✓ Seminar/ Presentation/ Assignment/ Quiz/ Class Test/ Peer-group discussion etc.: 5 ✓ Mid-Term Exam: 10 ➤ Practicum ✓ Class Participation: NA ✓ Seminar/ Demonstration/ Viva-voce/ Lab records etc.: 10		➤ Theory ✓ Written Examination: 50 ➤ Practicum ✓ Practical Examination: 20

✓ Mid-Term Exam: NA	
Part C - Recommended Books/ e-resources	
• Singh, A.K. & Kumar A. 2023. Plant Propagation and Nursery management. S.K. Kataria and sons. • Arora, J.S. 2016. Introductory Ornamental Horticulture. Kalyani Publishers. 8th edition. • Jain, S.M. & Ochatt, S.J. 2009. Protocols for in vitro propagation of ornamental plants: 598 (Methods in Molecular Biology). Humana Press. • Prasad S & Kumar U. 2003. Commercial Floriculture. Agrobios • Lauria A & Victor HR. 2001. Floriculture – Fundamentals and Practices Agrobios. • https://www.agmrc.org/commodities-products/specialty-crops/floriculture • https://www.india.gov.in/topics/agriculture/floriculture • https://www.apeda.gov.in/apedawebsite/six_head_product/floriculture.htm	

Subject: Botany**Semester IV (Session 2024-25)****Part A - Introduction**

Course Type and Remarks	Course Code	Name of the Course	Credit		Contact Hours/ week	Internal Assessment	End Term Marks	Max. Marks	Exam Duration (hrs.)
VOC-1 (4 Credits) Scheme A & C	24L5.0-VOC-BOT-402	Nursery and Gardening	T	3	3	20	50	70	3
VOC-2 (4 Credits) Scheme B			P	1	2	10	20	30	3

Level of the course (As per Annexure-I) –**Pre-Requisite for the course (if any):**

Learning Objectives: The main objective of this course is to acquire comprehensive knowledge and practical skills in nursery management and gardening, including plant propagation, soil preparation, pest and disease control, and the maintenance of ornamental and edible plants, to create and sustain aesthetically pleasing and ecologically balanced gardens.

Course Learning Outcomes (CLO): After completing this course, the learner will be able to

1. understand the infrastructure of nursery, seed production technology.
 2. develop a conceptual understanding the gardening procedure and, management of pest and diseases.
 3. gain knowledge about the vegetative propagation methods.
 4. learn about cultivation of different vegetables and flowers.
-
5. gain the knowledge of practical aspects of management of nursery, gardens, vegetative propagation methods, and cultivation of different vegetables and flowers.

Part B - Contents of the Course**Instruction for Paper Setter**

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit.

Unit	Topics	Contact Hours
I	Introduction to Nursery and Gardening: Definition, objectives and scope of nursery and gardening; importance of nursery management in horticulture and agriculture; overview of different types of gardening: landscape, home, and public gardens. Nursery Infrastructure and Planning: Nursery layout and design; building up infrastructure for nurseries - greenhouses, mist chambers, shade houses and glasshouses; planning and seasonal activities - planting, direct seeding and transplanting.	11

II	Seed Science and Technology: Structure and types; seed dormancy and methods to break dormancy; seed storage - seed banks, factors affecting seed viability, genetic erosion. Seed Production and Propagation Techniques: Seed production technology - seed testing and certification; vegetative propagation methods - air-layering, cutting, selection of cuttings, treatment of cuttings, rooting medium and planting of cuttings Hardening of plants and acclimatization techniques.	12
III	Gardening Operations and Management: Elements and principles of garden design; soil preparation, manuring, and watering; management of pests and diseases in gardens; sowing, raising of seeds and seedlings, and transplanting of seedlings Types of Gardening and Plant Materials: Landscape gardening: principles and design; home gardening: techniques and benefits; parks and their components: plant materials, design, and maintenance.	11
IV	Cultivation of Vegetables and Flowers: Cultivation techniques for vegetables- Cabbage, Brinjal, Lady's Finger, Onion, Tomatoes and Carrots Cultivation techniques for flowers - Marigold, Lilium, Rose, Gerbera, Gladiolus, Chrysanthemum and Carnation. Technology and Market Integration: Storage and marketing procedures for nursery and gardening products; sustainable practices and innovations in nursery management	11
V	Suggested Practical works	
	• Study of seed dormancy breakage by scarification and stratification. • Investigating the effect of different environmental conditions on seed germination. • Study of different tools used in gardening. • Bed preparation for growth of seedlings. • Raising of seedlings and transplantation. • Comparing the effects of different pruning methods, such as topping, thinning, or pinching, on plant growth, branching patterns, and flower production. • Study of different methods of vegetative propagation. Note: Any other relevant practical can be offered. Excursion Report: Report on excursion tours in nearby nursery to study the architecture and manufacturing and to recognize the seasonal ornamental crops.	30
Suggested Evaluation Methods		
Internal Assessment		End Term Examination
➤ Theory ✓ Class Participation: 5 ✓ Seminar/ Presentation/ Assignment/ Quiz/ Class Test/ Peer-group discussion etc.: 5 ✓ Mid-Term Exam: 10 ➤ Practicum ✓ Class Participation: NA ✓ Seminar/ Demonstration/ Viva-voce/ Lab records etc.: 10 ✓ Mid-Term Exam: NA		➤ Theory ✓ Written Examination: 50 ➤ Practicum ✓ Practical Examination: 20
Part C - Recommended Books/ e-resources		

- Singh, A.K. & Kumar A. 2023. Plant Propagation and Nursery Management. S.K.Kataria and sons.
- Ray, P.K. 2021. Essentials of Plant Nursery Management. Scientific publishers, India. 2nd edition.
- Taiz, L., Zeiger, E., Moller, I.M. and Murphy, A. 2015. Plant Physiology and Development. Sinauer Associates Inc. USA. 6th Edn.
- Ray, P.K. 2012. Plant Nursery Management: How to Start and Operate a Plant Nursery. Scientific publishers, India.
- Sinha, N.K., Hui, Y.H. 2011. Handbook of Vegetables & Vegetable Processing. Wiley-Blac, A John Wiley & Sons, Ltd.
- Jain, S.M. & Ochatt, S.J. 2009. Protocols for in vitro Propagation of Ornamental plants: 598 (Methods in Molecular Biology). Humana Press.
- Hopkins, W.G. and Huner, A. 2008. Introduction to Plant Physiology. John Wiley and Sons. U.S.A. 4th Edn.
- Mason, J. 2004. Nursery management. Landlinks Press.
- http://www.agritech.tnau.ac.in/horticulture/horti_Landscaping_nursery%20management.html
- <https://egyankosh.ac.in/bitstream/123456789/73071/1/Unit-1.pdf>
- <https://christuniversity.in/uploads/NURSERY%20MANAGEMENT%20AND%20GARDENING.pdf>

Subject: Botany

Semester V (Session 2024-25)

Part A - Introduction

Course Type and Remarks	Course Code	Name of the Course	Credit		Contact Hours/ week	Internal Assessment	End Term Marks	Max. Marks	Exam Duration (hrs.)
VOC-2 (4 Credits)	24L5.5-VOC-BOT-501	Organic Farming	T	3	3	20	50	70	3
Scheme A & C			P	1	2	10	20	30	3

Level of the course (As per Annexure-I) –

Pre-Requisite for the course (if any):

Learning Objectives: The main objective of this course is to gain a comprehensive understanding of the principles and practices of organic farming, including soil health management, pest and disease control and sustainable crop production methods.

Course Learning Outcomes (CLO): After completing this course, the learner will be able to

1. understand the need and concept of organic and integrated farming system.
2. develop a conceptual understanding of plant nutrients, utilization of biofertilizers.
3. gain knowledge about the disease and pest management.
4. learn about the use of plant products in organic farming, quality control and certification procedures of organic products.
5. gain the knowledge of practical aspects of organic and integrated farming system, role of nutrient in plant growth, utilization of plant and animal waste in organic farming, and also learn about the standardization procedures.

Part B - Contents of the Course

Instruction for Paper Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit.

Unit	Topics	Contact Hours
I	Basics of Organic Farming and Management: History, importance, concept and principle, advantages and disadvantages, status of organic farming in India, developing organic farms. Organic Certification and Standards: Certification process for organic farms, National and international standards (IFOAM, USDA Organic, India Organic).	11
II	Soil Health: Importance of soil health and soil fertility management (use of farm yard manure/ rural compost, mulching, city compost, animal wastes, vermicomposts, green manures, biofertilizers, etc.). Plant nutrients and Crop Management: Essential plant nutrients, their role in plant growth and development, nutrient management (NPK) in organic farming; selection of	12

	crops suitable for organic farming, planting, harvesting and crop rotation strategies. Organic agri- horticulture in urban & semi urban areas.	
III	Pest and Disease Management: Integrated pest managements (IPM), seed, seedling and soil treatment measures; biological control agents <i>viz.</i> beneficial insects, nematodes and microorganisms, organic pesticides and natural remedies; advantage over chemical pesticides. Weed Management: Cultural and mechanical weed control methods, use of cover crops and mulches, biological weed control options.	11
IV	Sustainable Practices and Innovations: Efficient irrigation techniques: drip, sprinkler, and rainwater harvesting, managing water quality for organic farming, waste management and recycling practices. Marketing and Socio-Economic Aspects: Market trends and consumer demand for organic products; branding, labeling and value addition; financial planning and risk management; Social benefits of organic farming: rural development, food security.	11
V	Suggested Practical works	
	• Preparation of compost by open air composting. • Preparation of vermicompost. • Determining the effectiveness of neem extract in pest control. • Comparative analysis of plants grown in the presence of organic and inorganic fertilizers. • Comparative analysis of nitrogen content in organic and inorganic fertilizers. • Comparative analysis of phosphorous content in organic and inorganic fertilizers. Note: Any other relevant practical can be offered. Excursion Report: Report on excursion tours in nearby organic farms.	30
Suggested Evaluation Methods		
Internal Assessment		End Term Examination
➤ Theory ✓ Class Participation: 5 ✓ Seminar/ Presentation/ Assignment/ Quiz/ Class Test/ Peer-group discussion etc.: 5 ✓ Mid-Term Exam: 10 ➤ Practicum ✓ Class Participation: NA ✓ Seminar/ Demonstration/ Viva-voce/ Lab records etc.: 10 ✓ Mid-Term Exam: NA		➤ Theory ✓ Written Examination: 50 ➤ Practicum ✓ Practical Examination: 20
Part C - Recommended Books/ e-resources		
• Chandran, S., Unni M.R., Thomas, S. Meena, D.K. 2023. Organic Farming: Global Perspectives and Methods. Elsevier. • Somasundaram, E. Udhaya Nandhini, D., Meyyappan, M. 2021. Principles of Organic Farming. CRC Press. • Chandran, S., Thomas, S., Unni M.R. 2019. Organic Farming: New Advances Towards Sustainable Agricultural Systems. Springer.		

- Giri b, Prasad, R. Qiang-Sheng, W. & Varma A. 2019. Biofertilizers for sustainable agriculture and environment (Soil Biology Book 55). Springer.
- Chandran, S., Unni M.R., Thomas, S. 2018. Organic Farming: Global Perspectives and Methods. Elsevier.
- Subbarao, N.S. 2017. Bio-fertilizers in Agriculture and Forestry. MedTech Publishers. 4th Edn.
- Hermary, H. 2007. Working with nature. Gaia College Inc.
- <https://ofrf.org/>
- <https://nconf.dac.gov.in/>
- <https://elearn.nptel.ac.in/shop/nptel/organic-farming-for-sustainable-agricultural-production/?v=c86ee0d9d7ed>

Subject: Botany
Semester VI (Session 2024-25)

Part A - Introduction

Course Type and Remarks	Course Code	Name of the Course	Credit		Contact Hours/ week	Internal Assessment	End Term Marks	Max. Marks	Exam Duration (hrs.)
VOC-3 (4 Credits) Scheme A, B & C	24L5.5-VOC-BOT-601	Mushroom Cultivation	T	3	3	20	50	70	3
			P	1	2	10	20	30	3

Level of the course (As per Annexure-I) –

Pre-Requisite for the course (if any):

Learning Objectives: The main objective of this course is to acquire comprehensive knowledge and practical skills in mushroom cultivation, including understanding the biology and lifecycle of mushrooms, preparing and managing growing substrates, controlling environmental conditions, identifying and managing pests and diseases, and implementing post-harvest handling and marketing techniques.

Course Learning Outcomes (CLO): After completing this course, the learner will be able to

1. understand the nutritional and medicinal value of edible mushrooms.
2. develop a conceptual understanding of various procedure and techniques used for mushroom cultivation.
3. gain knowledge about the storage procedure of different types of edible mushrooms.
4. learn about different types of food prepared from mushrooms and their medicinal value.
5. gain the knowledge of practical aspects of mushroom cultivation.

Part B - Contents of the Course

Instruction for Paper Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit.

Unit	Topics	Contact Hours
I	Introduction to Mushroom Cultivation: History and importance, nutritional and medicinal value; types of edible mushrooms: <i>Volvariella volvacea</i> , <i>Pleurotus citrinopileatus</i> , <i>Agaricus bisporus</i> ; overview of poisonous mushrooms. Required Infrastructure: Substrates (locally available), polythene bags, vessels; inoculation tools - hook, loop; low-cost stoves, sieves, culture racks, mushroom unit setup.	11
II	Pure Culture Techniques: Preparation of culture medium; sterilization methods; preparation and multiplication of spawn. Mushroom Bed Preparation: Using paddy straw, sugarcane trash, maize straw, banana leaves; factors affecting bed preparation - low-cost technology, composting technology in mushroom production.	11
III	Cultivation Techniques: Different cultivation methods - bed, bag, tray systems; management of the cultivation cycle - spawning, incubation, cropping and harvesting.	11

	Nutritional Value and Food Preparation: Nutritional value of commercially available mushrooms- proteins, amino acids, minerals, carbohydrates, crude fibre, vitamins; Food preparation - types of foods prepared from mushrooms.	
IV	Harvest and Storage Techniques: Harvesting techniques and timing; post-harvest handling: cleaning, packaging, and storage; short-term storage methods, long-term storage - canning, pickling, drying, storage in salt solutions. Pest and Disease Management and Marketing: Identification, prevention, and control of common pests and diseases in mushroom cultivation; cost-benefit ratio of mushroom cultivation; marketing strategies in India and abroad; export value of mushrooms.	12
V	Suggested Practical works	
	• Sterilization and preparation of media for spawn. • Preparation of mushroom bed with different substrates. • Cultivation of <i>Pleurotus</i> sp., <i>Agaricus</i> sp. • Evaluation of total soluble sugar content of commonly available mushrooms. • Evaluation of total protein content of commonly available mushrooms. • Preparation of dried mushroom powder for long term storage and its nutrient evaluation. Note: Any other relevant practical can be offered.	30
	Excursion Report: Report on excursion tours in nearby mushroom cultivation nursery.	
Suggested Evaluation Methods		
Internal Assessment		End Term Examination
➤ Theory ✓ Class Participation: 5 ✓ Seminar/ Presentation/ Assignment/ Quiz/ Class Test/ Peer-group discussion etc.: 5 ✓ Mid-Term Exam: 10 ➤ Practicum ✓ Class Participation: NA ✓ Seminar/ Demonstration/ Viva-voce/ Lab records etc.: 10 ✓ Mid-Term Exam: NA		➤ Theory ✓ Written Examination: 50 ➤ Practicum ✓ Practical Examination: 20
Part C - Recommended Books/ e-resources		
• Bray, R. 2019. Mushroom cultivation: 12 ways to become the MacGyver of Mushrooms. Urban Homesteading. • Kumaresan, V. 2018. Mushroom cultivation. Saras Publication. • Gour, P.Y. 2010. Mushroom Production and Processing Technology. Agrobios India. • Powell, M. 2010. Medicinal mushrooms: A clinical guide. Mycology Press. • Bahl, N. 2000. Handbook on Mushrooms. Oxford & IBH Publishing Co. Pvt. Ltd. • https://www.iihr.res.in/mushroom • https://icar.org.in/node/5830 • https://dmrsolan.icar.gov.in		