Syllabus of VAC, SEC, VOC
for Under-Graduate Programme
Under Multiple Entry-Exit, Internship and
CBCS-LOCF in accordance to NEP-2020
w.e.f. 2024-25 (in phased manner)

DEPARTMENT OF BOTANY

CHAUDHARY BANSI LAL UNIVERSITY, BHIWANI

VAC-VALUE ADDED COURSE

Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration
VAC-1	24UN-BOT-VAC101	Environmental Studies	2	2	15	35	50	3 hrs.

Level of the course: NA

Pre-requisite for the course (if any): NA

Course Learning Outcomes (CLO):

1. Understand the,concept of environmental studies, sustainable development and ecosystem.
2. Learn about the various natural resources and about biodiversity and its conservation.
3. Know about the types of pollution, solid waste management, global environmental issues and environmental laws.
4. Understand the concept of population growth and its impacts on environment and disaster management.

Instructions for Paper-Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	**Introduction to environmental studies:** Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development. **Ecosystems:** Definition, structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs, Major ecosystems types: Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystem (lakes, rivers, oceans).	6
II	**Natural resources: Renewable and Non- renewable Resources:** Land resources: Land degradation and soil erosion. Forest resources: Importance of forests, deforestation: causes and impacts on environment. Water resources: Use and over- exploitation of surface and ground water. Energy resources: Renewable and non- renewable energy sources. **Biodiversity and Conservation:** Definition and its types, Endangered and endemic species of India. Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation biodiversity: In-situ and Ex-situ conservation of biodiversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and informational values.	9
III	**Environmental pollution** Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution. Solid waste management: Sources, methods of disposal: Landfill, incineration and composting, Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture. **Environmental Policies & Practices** Environmental laws: Environment (Protection) Act, 1986, Air (Prevention & Control of Pollution) Act, 1981, Water (Prevention and control of Pollution) Act, 1974.	8
IV	**Human Communities and the Environment:** Human population growth: Impacts on environment, human health and welfare. Resettlement and rehabilitation of project affected person. Disaster management: floods, earthquake, cyclones, landslides and drought. Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.	7

Suggested Evaluation Methods

Internal Assessment:

- Theory
  - Class Participation: 4
  - Seminar/presentation/assignment/quiz/class test etc.: 4
  - Mid-Term Exam: 7

End Term Examination:

- Theory
  - Written Examination: 35

Learning Resources

1. Kaushik, A & Kaushik, C.P. 2022. Perspectives in Environmental Studies. New Age International Pvt Ltd, New Delhi.
2. Bharucha, E. 2021. A Textbook of Environmental Studies for Undergraduate Courses, Orient Blackswan Pvt Ltd.
3. Goswami, P., Mandal, J. & Singh, S. 2022. A Textbook on Environmental Studies, Ashok book stall, Assam.
4. Joshi, P.C. & Joshi, N. 2009. A Text Book of Environmental Science. APH Publishing Corporation.
5. Basu, M. & Xavier Savarimuthu, S.J. 2017. Fundamentals of Environmental Studies. Cambridge University Press.
6. Singh, R.P. & Islam, Z. 2012. Environmental Studies. Concept Publishing Company.

VAC-VALUE ADDED COURSE

Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration
VAC-3	24UN-BOT-VAC301	**Medicinal Plants in everyday life**	2	2	15	35	50	3 hrs.

Level of the course: NA

Pre-requisite for the course (if any): NA

Course Learning Outcomes (CLO):

1. Know about an overview of history of Ayurvedic system and medicine
2. Understand various general medicinal plants
3. Understand various advanced medicinal plants
4. Knowledge about post harvesting of medicinal plants.
5. The course deals with the basic knowledge of Medicinal Plants including their evolution, structure and applications. It will also help them to understand their importance and need for conservation.

Instructions for Paper-Setter

3. Nine questions will be set in all. All questions will carry equal marks.
4. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	General account of medicinal plants: Origin and History of Ayurvedic system of medicine, Diversity and Classification of medicinal plants, General account on applications and utility of medicinal plants.	8
II	General Medicinal Plants: Vernacular name, Morphology, Plant Part used and applications of General Medicinal Plants: *Azadirachta indica*, *Acacia nilotica*, *Aloe barbadensis*, *Calotropis procera*, *Ficus religiosa*, *Allium sativum*, *Ocimum sanctum*, *Citrus* sp.	8
III	Advanced Medicinal Plants: Vernacular name, Morphology, Plant Part used and applications of Advance Medicinal Plants: *Cannabis sativa*, *Rauwolfia serpentine*, *Withania somnifera*, *Papaver somniferum*, *Solanum indicum*, *Abutilon indicum*, *Ricinus communis*, *Datura* sp., *Terminalia* sp., *Cinchona*.	7
IV	General account on Post Harvesting Procedures: Processing, Utilization & Storage of medicinal plants, Quality control and evaluation of herbal drugs, Adverse effects of imbalanced herbal medicines intake, Threats and conservation of medicinal plants.	7

Suggested Evaluation Methods

Internal Assessment:

➢ **Theory**
- Class Participation: 4
- Seminar/presentation/assignment/quiz/class test etc.: 4
- Mid-Term Exam: 7

End Term Examination:

➢ **Theory**
- Written Examination: 35

Learning Resources

1. Kocchar, S.L. Economic Botany of Tropics, Macmillan India Publisher.
2. Choprā R.N., Nayar S.L. and Chopra I.C.: Glossary of Indian Medicinal Plants. Publication and Information Directorate CSIR, New Delhi.
3. Ambasta S. P.: The Useful Plants of India. Publication & Directorate, CSIR, New Delhi.
4. Cracker L.E. and Simon J.E. (ed. by) Herbs, Spices and Medicinal Plants: Recent Advances in Botany, Horticulture and Pharmacology (Ind. Reprint). CBS Publishers & Distributors, New Delhi
5. Kirtikar K.R. and Basu B.D.: Indian Medicinal Plants

VAC-VALUE ADDED COURSE								
Course Type	**Course Code**	**Name of the Course**	**Credit**	**Contact Hours/ Week**	**Internal Assessment marks**	**End Term Marks**	**Max. Marks**	**Exam Duration**
VAC-4	**24UN-BOT-VAC401**	**Indian Biodiversity**	**2**	**2**	**15**	**35**	**50**	**3 hrs.**

Level of the course: NA

Pre-requisite for the course (if any): NA

Course Learning Outcomes (CLO):

1. Know about an overview of Indian Biodiversity
2. Understand various strategies of biodiversity conservation
3. Improve their knowledge about Important Protected areas
4. To identify the local biodiversity

Instructions for Paper-Setter

Nine questions will be set in all. All questions will carry equal marks.

Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	An overview of Indian Biodiversity; Faunal and Floral Indian biodiversity, Definition and concept of Biodiversity; Important Biodiversity area of India, Biodiversity: levels, values and threats and conservation	8
II	Popular Biosphere Reserves and their biodiversity, Popular Tourist spots of Rich Biodiversity, In-situ and Ex-situ conservation of biodiversity	8
III	Protected Areas and their roles in biodiversity conservation, Important National Park and Wildlife sanctuaries, IUCN categories, Threatened categories	7
IV	Terrestrial Biodiversity, Aquatic and Coastal biodiversity, Biodiversity hotspots, their characteristic flora and fauna, Biodiversity resources of north-east India.	7

Suggested Evaluation Methods

Internal Assessment:

- **Theory**
  - Class Participation: 4
  - Seminar/presentation/assignment/quiz/class test etc.: 4
  - Mid-Term Exam: 7

End Term Examination:

- **Theory**
  - Written Examination: 35

Learning Resources

1. Thammineni Pullaiah and Sandhya Rani (2016) " Biodiversity in India" Volume: Regency Publications
2. Shukla Mahanty and Anjali Srivastava (2016). "Biodiversity And It's Conservation" Disha International Publishing House
3. Ramakrishanan, N "Biodiversity in Indian Scenarios" Daya Publishing House, New Delhi
4. Erach Bharucha (2002) "The Biodiversity of India" Mapin Pub.
5. Asad R. Rahmani and Dhritiman Mukherjee (2016) "Magical Biodiversity Of India" Oxford University Press

SEC-SKILL ENHANCEMENT COURSE

Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration
SEC-2	24UN-BOT-SEC201	Organic Farming	2	2	15	35	50	3 hrs.
		Practical	1	2	5	15	20	3 hrs.

Level of the course: NA

Pre-requisite for the course (if any): NA

Course Learning Outcomes (CLO):

1. Students will be able to understand the need and concept of organic and integrated farming system.
2. Students will develop a conceptual understanding of plant nutrients, utilization of biofertilizers.
3. Students will gain knowledge about the disease and pest management
4. Students will learn about the use of plant products in organic farming, quality control and certification procedures of organic products
5. Students will 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.

Instructions for Paper-Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	**Basics of organic farming**: Concept and components of organic farming, aims and objectives; Need of organic farming; Advantages and disadvantages of organic farming. Organic farming process- Concept of farming system, Developing organic farms, Important steps & methods; Pure organic farming and integrated farming system (combination of organic and inorganic).	8
II	**Plant nutrients:** Essential plant nutrients, their role in plant growth and development,. Nutrient management in organic farming: Balanced nutrients supply for organic farming system using nutrients from organic sources.Preparation, nutrient content and methods of use of following- FYM/Rural compost, mulching, city compost, oil cakes, animal wastes, vermicomposts, vermiwash, jeevamrit, beejamrit, green manures, biofertilizers.	8
III	**Bio fertilizers and their method of use:** Nitrogenous, Phosphatic, Potassic, availability of nutrients from above sources. Recycling of organic matter in organic agriculture-Transformation of organic substances in soil. Disease and pest management in organic farming-Integrated pest & disease managements; Organic pesticides, bio-pesticides; Inorganic pesticides, disadvantages of their use; Seed, seedling and soil treatment measures; Feasibility of complete dependence on organic sources.	7
IV	**Quality control:** Use of Neem and other plant products in organic farming; Organic agrihorticulture in urban & semi urban areas. Certification, Standardization, Marketing - Quality control and certification procedures of organic products. Organic standards In India. Govt. schemes related to organic farming in India. Potential demand and Marketing of organic products. Organic farming and food security in India.	7
V Practical	1. Preparation of compost by open air composting. 2. Preparation of vermicompost. 3. Comparative analysis of plants grown in compost prepared in 1 and 2. 4. Determining the effectiveness of neem extract in pest control. 5. Comparative analysis of plants grown in the presence of organic andinorganic fertilizers. 6. Comparative analysis of nitrogen content in organic and inorganicfertilizers. 7. Comparative analysis of phosphorous content in organic and inorganicfertilizers.	30

Suggested Evaluation Methods	
Internal Assessment: ➢ **Theory** • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.: 4 • Mid-Term Exam: 7 ➢ **Practicum** • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 5 • Mid-Term Exam: NA	**End Term Examination:** ➢ **Theory** Written Examination: 35 ➢ **Practicum** ➢ Practical Examination: 15

Learning Resources

1. Chandran, S., Unni M.R., Thomas, S. Meena, D.K.. Organic Farming: Global Perspectives and Methods. Elsevier.
2. Somasundaram, E. Udhaya Nandhini, D., Meyyappan, M.. Principles of Organic Farming. CRC Press.
3. Chandran, S., Thomas, S., Unni M.R. Organic Farming: New Advances Towards Sustainable Agricultural Systems. Springer.
4. Giri b, Prasad, R. Qiang-Sheng, W. & Varma A. Biofertilizers for sustainable agriculture and environment (Soil Biology Book 55). Springer.
5. Chandran, S., Unni M.R., Thomas, S. Organic Farming: Global Perspectives and Methods. Elsevier.
6. Subbarao, N.S. Bio-fertilizers in Agriculture and Forestry. MedTech Publishers.

SEC-SKILL ENHANCEMENT COURSE

Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration
SEC-2	24UN-BOT-SEC301	Herbal Technology	2	2	15	35	50	3 hrs.
		Practical	1	2	5	15	20	3 hrs.

Level of the course: NA

Pre-requisite for the course (if any): NA

Course Learning Outçomes (CLO):

1. Knowledge of the Indian system of herbal medicines.
2. Identification and utilization of the medicinal herbs.
3. Understanding the screening and characterization of herbal products.
4. This course is intended to provide knowledge of herbal plants & their utilization. To understand the fundamentals of various systen of herbal medicines, screening and its standardizations.

Instructions for Paper-Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eightquestions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	Herbal Medicines: History and scope, definition of medical terms, role of medicinal plants in Siddha systems of medicine. Cultivation, harvesting, processing, storage, marketing, and utilization of medicinal plants. Medicinal plant banks	8
II	Phytochemistry: Active principles and methods of testing in herbal plants. Identification and utilization of medicinal herbs from *Catharanthus roseus* (cardiotonic), *Withania somnifera* (drugs acting on nervous system), *Clerodendron phlomoides* (anti-rheumatic) and *Centella asiatica* (memory boosters).	8
III	Pharmacognosy: Concept of Pharmacognosy, systematic position and medicinal uses of the following herbs in curing various ailments: Tulsi, Ginger, Turmeric, Fenugreek, Indian Gooseberry and Ashoka. Herbal foods, future of pharmacognosy.	7
IV	Analytical Pharmacognosy: Drug adulteration- types, methods of drug evaluation, biological testing of herbal drugs. Phytochemical screening tests for secondary metabolites (alkaloids, flavonoids, steroids, tri-terpenoids, phenolic compounds).	7
V Practical	1. Visit to a botanical garden or natural habitat to identify and collect medicinal plants. 2. Identification of herbal plants; 3. To study the Methods for drying herbs using air drying, dehydrators, and ovens. 4. Enlist the different types of herbal plants in your locality.	30

Suggested Evaluation Methods	
Internal Assessment: ➢ **Theory** • Class Participation: 4	**End Term Examination:** ➢ **Theory** • Written Examination: 35
• Seminar/presentation/assignment/quiz/class test etc.: 4 • Mid-Term Exam: 7 ➢ **Practicum** • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 5 • Mid-Term Exam: NA	➢ **Practicum** ➢ Practical Examination: 15

Learning Resources

1. Glossary of Indian medicinal plants, R.N., Chopra, S.L., Nayarandl., C., Chopra, .C.S.I.R, New Delhi.
2. The indigenous drugs of India, Kanny, Lall, Deyand Raj Bahadur. International Book Distributors.
3. Pharmacognosy, Dr. C.K., Kokate et al. Nirali Prakashan.
4. Herbal plants and Drugs Agnes Arber. Mangal Deep Publications.
5. Ayurvedic drugs and their plant source. V.V., Sivarajan & Balachandran Indra, Oxford IBH publishing Co.
6. Ayurveda and Aromatherapy, Miller, Light and Miller, Bryan. Banarsidass, Delhi.
7. Principles of Ayurveda, Anne Green. Thomsons, London.

SEC-SKILL ENHANCEMENT COURSE

Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration
SEC-2	24UN-BOT-SEC601	Floriculture	2	2	15	35	50	3 hrs.
		Practical	1	2	5	15	20	3 hrs.

Level of the course: NA

Pre-requisite for the course (if any): NA

Course Learning Outcomes (CLO):

1. Students will be able to understand the importance and scope of floriculture, management of nursery and gardens, methods of plant propagation.
2. Students will develop a conceptual understanding of different types ofornamental plants.
3. Students will gain knowledge about the various types of gardens andimportance of landscaping.
4. Students will learn about commercial floriculture and cultivation ofimportant cut flowers.

Instructions for Paper-Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set-unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	Introduction: History, importance and scope of floriculture and landscape gardening. Nursery management and routine garden operations: Sexual and vegetative methodsof propagation; Soil sterilization; Seed sowing; Pricking; Planting and transplanting;Shading; Stopping or pinching; Defoliation; Wintering; Mulching; Topiary; Role ofplant growth regulators	8
II	Ornamental Plants: Flowering annuals; Herbaceous perennials; Divine vines; Shade and ornamental trees; Ornamental bulbous and foliage plants; Cacti and succulents; Palms and Cycads; Ferns and Selaginellas; Cultivation of plants in pots; Indoor gardening; Bonsai.	7
III	Principles of Garden Designs: English, Italian, French, Persian, Mughal and Japanese gardens; Features of a garden (garden wall, fencing, steps, hedge, edging, lawn, flower beds, shrubbery, borders, water garden. Some famous gardens of India. Landscaping of places of public importance: Landscaping highways and educational institutions.	8
IV	Commercial floriculture: Factors affecting flower production; Production andpackaging of cut flowers; Flower arrangements; Methods to prolong vase life. Cultivation of Important cut flowers- Carnation, Aster, Chrysanthemum, Dahlia,Gerbera, Gladiolous, Marigold, Rose, Lilium). Diseases and Pests of Ornamental Plants.	7
V Practical	1. Plant propagation by cutting. 2. Plant propagation by grafting. 3. Plant propagation by air-layering. 4. Investigating the effect of different flower preservatives on the vase life of commonornamental flowers. 5. Setting up a laboratory scale hydroponics setup. 6. Preparation of different types of floral arrangements. 7. Morpho-anatomical study of different types of flowers. 8. Study of different diseases in ornamental plants.	30

Suggested Evaluation Methods	
Internal Assessment: ➢ **Theory** • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.: 4 • Mid-Term Exam: 7 ➢ **Practicum** • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 5 • Mid-Term Exam: NA	**End Term Examination:** ➢ **Theory** • Written Examination: 35 ➢ **Practicum** ➢ Practical Examination: 15

Learning Resources

1. Singh, A.K. & Kumar A. 2023. Plant Propagation and Nursery management. S.K. Kataria and sons.
2. Arora, J.S. 2016. Introductory Ornamental Horticulture. Kalyani Publishers. 8th edition.
3. Jain, S.M. & Ochatt, S.J. 2009. Protocols for in vitro propagation of ornamental plants: 598 (Methods inMolecular Biology). Humana Press.
4. Prasad S & Kumar U. 2003. Commercial Floriculture. Agrobios
5. Lauria A & Victor HR. 2001. Floriculture – Fundamentals and Practices Agrobios.

VOC-VOCATIONAL COURSE								
Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration
VOC-1	24UN-BOT-VOC301	Biofertilizers	3	3	20	50	70	3 hrs.
		Practical	1	2	10	20	30	4 hrs.

Level of the course: NA

Pre-requisite for the course (if any): NA

Course Learning Outcomes (CLO):

1. Visualize and identify different types of microorganisms with a compound microscope.
2. Understand the classification of microorganisms according to their shape/ structure for morphological identification.
3. Prepare and sterilize different types of culture media.
4. Isolate of microorganisms from the environmental samples and culture in aseptic conditions.

Instructions for Paper-Setter

3. Nine questions will be set in all. All questions will carry equal marks.
4. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attemptquestion No. 1 and four more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	Introduction: Introduction to microbial inoculants or biofertilizers, macro and micro nutrition of plants, chemical fertilizers versus biofertilizers; Methods and steps in mass multiplication of biofertilizers: stock culture, broth culture, growth medium,fermentation, blending with the carrier, packaging, and quality check, ISI standard specification for biofertilizers; scope of biofertilizers in India.	11
II	Microbial Inoculants: Study of important microbial inoculants: Rhizobium, Azospirillum, Azotobacter, Actinorhizae; Characteristics, isolation, identification, and crop response.	11
III	Role of Cyanobacteria: Role of Cyanobacteria (blue-green algae) in rice cultivation; Azolla and Anabaena azollae association, nitrogen fixation, and factors affecting growth.	12
IV	Mycorrhizal association: Types of mycorrhizal association, taxonomy, occurrence and distribution; Role of Arbuscular mycorrhizal fungi in phosphorus nutrition, growth and yield of crop plants; AMF – methods in isolation (wet sieving and decanting), identification (morphological and molecular methods). Methods of inoculum production (Pot culture and root culture).	11
V Practical	1. Study of Rhizobium from root nodules of leguminous plants by Gram staining method. 2. Observation of arbuscular mycorrhizal fungi from plant roots. 3. Isolation of arbuscular mycorrhizal spores from rhizosphere soil. 4. Isolation of Anabaena from Azolla leaf. 5. Study of Earthworm, Azolla, AMF: Arbuscules-vesicles through specimen / digital resources. 6. Study of Biocontrol methods and their application -Pheromone trap, Trichoderma, Pseudomonas, Neem etc. through digital resources. 7. Rapid test for pH, NO3−, SO42−, Cl− and organic matter of different composts	30

Suggested Evaluation Methods	
Internal Assessment: ➢ **Theory** • Class Participation: 4	**End Term Examination:** ➢ **Theory** • Written Examination: 50
• Seminar/presentation/assignment/quiz/class test etc.: 4 • Mid-Term Exam: 7 ➢ **Practicum** • Class Participation: 5 • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA	➢ **Practicum** ➢ Practical Examination: 20

Learning Resources

1. Kumaresan, V. Biotechnology. New Delhi, Delhi: Saras Publication.
2. Sathe, T.V. Vermiculture and Organic Farming. New Delhi, Delhi: Daya publishers.
3. Subha Rao, N.S. Soil Microbiology, 5th edn. New Delhi, Delhi: Oxford & IBH Publishers.
4. Reeta Khosla, Biofertilizers and Biocontrol Agents for Organic Farming, Kojo Press.
5. Vayas, S.C, Vayas, S., Modi, H.A. Bio-fertilizers and organic Farming. Nadiad, Gujarat: Akta Prakashan

VOC-VOCATIONAL COURSE								
Course Type	**Course Code**	**Name of the Course**	**Credit**	**Contact Hours/ Week**	**Internal Assessment marks**	**End Term Marks**	**Max. Marks**	**Exam Duration**
VOC-2	24UN-BOT-VOC401	Nursery and Gardening	3	3	20	50	70	3 hrs.
		Practical	1	2	10	20	30	4 hrs.

Level of the course: NA

Pre-requisite for the course (if any): NA

Course Learning Outcomes (CLO):

1.Students will be able to understand the infrastructure of nursery, seed production technology
2: Students will develop a conceptual understanding the gardening procedure and management of pest and diseases.
3: Students will gain knowledge about the vegetative propagation methods.
4: Students will learn about cultivation of different vegetables and flowers.

Instructions for Paper-Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attemptquestion No. 1 and four more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	Nursery: Definition, objectives and scope and building up of infrastructure for nursery, planning and seasonal activities – planting, direct seeding and transplants. Seed: Structure and types -Seed dormancy; causes and methods of breaking dormancy Seed storage: Seed banks, factors affecting seed viability, genetic erosion. Seed production technology: Seed testing and certification.	11
II	Gardening: definition, objectives and scope - different types of gardening - landscape and home gardening - parks and its components - plant materials and design. Gardening operations: Soil laying, manuring, watering, management of pests and diseases and harvesting, sowing/raising of seeds and seedlings, transplanting of seedlings. Computer applications in landscaping.	12
III	Vegetative propagation: air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings. Hardening of plants - greenhouse - mist chamber, shed root, shade house and glass house.	11
IV	Cultivation of different vegetables: Cabbage, Brinjal, Lady's finger, Onion, Tomatoes and carrots Cultivation of different flowers: Marigold, Lilium, Rose, Gerbera, Gladiolus, Chrysanthemum and Carnation. Storage and marketing procedures	11
V Practical	**Practical** 1. Study of seed dormancy breakage by scarification and stratification. 2. Investigating the effect of different environmental conditions on seed germination. 3. Study of different tools used in gardening. 4. Bed preparation for growth of seedlings. 5. Raising of seedlings and transplantation. 6. Comparing the effects of different pruning methods, such as topping, thinning, or pinching, on plant growth, branching patterns, and flower production. 7. Study of different methods of vegetative propagation.	30

Suggested Evaluation Methods	
Internal Assessment: ➢ **Theory** • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.: 4 • Mid-Term Exam: 7 ➢ **Practicum** • Class Participation: 5 • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA	**End Term Examination:** ➢ **Theory** • Written Examination: 50 ➢ **Practicum** ➢ Practical Examination: 20

Learning Resources

1. Singh, A.K. & Kumar A. Plant Propagation and Nursery management. S.K. Kataria and sons.
2. Ray, P.K. Essentials of Plant nursery management. Scientific publishers, India. 2nd edition.
3. Taiz, L., Zeiger, E., Moller, I.M. and Murphy, A. Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.
4. Ray, P.K. Plant nursery management: how to start and operate a plant nursery. Scientific publishers, India.
5. Sinha, N.K., Hui, Y.H. Handbook of vegetables & vegetable processing. WileyBlac, A John Wiley & Sons, Ltd.
6. Jain, S.M. & Ochatt, S.J. Protocols for in vitro propagation of ornamental plants: 598 (Methods in Molecular Biology). Humana Press.
7. Hopkins, W.G. and Huner, A. Introduction to Plant Physiology. John Wiley and Sons.U.S.A. 4th edition.

VOC-VOCATIONAL COURSE

Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration
VOC-2	24UN-BOT-VOC601	Mushroom Cultivation	3	3	20	50	70	3 hrs.
		Practical	1	2	10	20	30	4 hrs.

Level of the course: NA

Pre-requisite for the course (if any): NA

Course Learning Outcomes (CLO):

1. Students will be able to understand the nutritional and medicinal value of edible mushrooms.
2. Students will develop a conceptual understanding of various procedure and techniques used for mushroom cultivation.
3. Students will gain knowledge about the storage procedure of different types of edible mushrooms.
4. Students will learn about different types of food prepared from mushrooms and their medicinal value.
5. The objective of a mushroom cultivation course is to equip students with the knowledge, skills, and practical experience needed to successfully cultivate mushrooms for various purposes, whether for personal consumption, commercial production, research, or environmental conservation.

Instructions for Paper-Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attemptquestion No. 1 and four more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	Introduction and Required infrastructure: Introduction, nutritional and medicinal value of edible mushrooms; poisonous mushrooms, types of edible mushrooms available in India- Volvariella volvacea, Pleurotus citrinopileatus, Agaricus bisporus. Required infrastructure: substrates (locally available), polythene bags, vessels, inoculation hook, inoculation loop, low cost stoves, sieves, culture racks, mushroom unit (thatched house), water sprayer, tray, etc.	11
II	Pure culture: medium, sterilization, preparation of spawn, multiplication. Mushroom bed preparation- paddy straw, sugarcane trash, maize straw, banana leaves, Factors affecting the mushroom bed preparation- low cost technology, composting technology in mushroom production .	12
III	Storage: short term storage, long term storage (canning, pickels, papads), drying, storage in salt solutions. Nutritional value of some common commercially available mushrooms: proteins, amino acids, mineral elements nutrition, carbohydrates, crude fibre content and vitamins.	11
IV	Food preparation: type of foods prepared from mushrooms. Medicinal value of edible mushrooms. Research centres: National level and regional level. Cost benefit ratio: marketing in India and abroad. Export value.	11
V Practical	1. Sterilization of media for spawn preparation. 2. Preparation of spawn and multiplication. 3. Preparation of mushroom bed with different substrates. 4. Cultivation of Pleurotus sp. 5. Cultivation of Agaricus sp. 6. Evaluation of total soluble sugar content of commonly available mushrooms. 7. Evaluation of total protein content of commonly available mushrooms. 8. Preparation of dried mushroom powder for long term storage and its nutrient evaluation.	30

Suggested Evaluation Methods	
Internal Assessment: ➢ **Theory** • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.: 4 • Mid-Term Exam: 7 ➢ **Practicum** • Class Participation: 5 • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA	**End Term Examination:** ➢ **Theory** • Written Examination: 50 ➢ **Practicum** ➢ Practical Examination: 20

Learning Resources

1. Bray, R. Mushroom cultivation: 12 ways to become the MacGyver of Mushrooms. Urban Homesteading.
2. Kumaresan, V. Mushroom cultivation. Saras Publication.
3. Russell, S. The essential guide to cultivating mushrooms: Simple and advanced techniques for growing Shiitake, Oyster, Lion's mane and Maitake mushrooms at home. Storey publishing LLC.
4. Gour, P.Y. Mushroom Production and Processing Technology. Agrobios India.
5. Powell, M. Medicinal mushrooms: A clinical guide. Mycology Press.
6. Cheung, P.C. Mushrooms as Functional foods. Willey-Interscience.
7. Tripathi, D.P. Mushroom Cultivation. Oxford & IBH Publishing Co. PVT.LTD, New Delhi.
8. Paul Stamets, J.S. & Chilton, J.S. Mushroom cultivation: A practical guide to growing mushrooms at home. Agarikon Press.