

SYLLABI AND SCHEME OF EXAMINATIONS FOR SKILL ENHANCEMENT COURSES FOR UNDER GRADUATE PROGRAM OFFERED BY THE DEPARTMENT OF BOTANY

**Bachelor of Science (Botany as Single Major) Program
with Hons. in Botany**

(Based on Curriculum and Credit Framework for UG Programs under NEP 2020)



**WITH EFFECT FROM
THE
SESSION 2024-25**

**MAHARSHI DAYANAND UNIVERSITY
ROHTAK (HARYANA)**

SCHEME OF EXAMINATIONS FOR SKILL ENHANCEMENT COURSES FOR UNDER GRADUATE PROGRAM OFFERED BY THE DEPARTMENT OF BOTANY FOR BACHELOR OF SCIENCE (Botany as Single Major) WITH HONS. IN BOTANY

| Skill Enhancement Course (SEC) | Nomenclature of Course | Course Code | Credits Distribution | | | Total Credits | Workload | | | Total Workload | Marks | | | | Total Marks |
|--|---|--------------|----------------------|---|---|---------------|----------|---|---|----------------|----------|----------|-----------|----------|-------------|
| | | | L | T | P | | L | T | P | | Theory | | Practical | | |
| | | | | | | | | | | | Internal | External | Internal | External | |
| SEMESTER I (2024-25) | | | | | | | | | | | | | | | |
| SEC 1 @ 3 credits | Biofertilizers & Biopesticides | 24BOT401SE01 | 2 | 0 | 1 | 3 | 2 | 0 | 2 | 4 | 15 | 35 | 5 | 20 | 75 |
| SEMESTER II (2024-25) | | | | | | | | | | | | | | | |
| SEC 2 @ 3 credits | Floriculture | 24BOT402SE01 | 2 | 0 | 1 | 3 | 2 | 0 | 2 | 4 | 15 | 35 | 5 | 20 | 75 |
| SEMESTER III (2024-25) | | | | | | | | | | | | | | | |
| SEC 3 @ 3 credits | Plants Propagation & Nursery Techniques | 25BOT403SE01 | 2 | 0 | 1 | 3 | 2 | 0 | 2 | 4 | 15 | 35 | 5 | 20 | 75 |
| SEMESTER VI (2024-25) | | | | | | | | | | | | | | | |
| SEC 4 @ 2 credits (offered only in case of Single Major Programme) | Home Gardening | 26BOT406SE01 | 1 | 0 | 1 | 2 | 1 | 0 | 2 | 3 | 5 | 25 | 5 | 25 | 50 |
| SEMESTER VII (2024-25) | | | | | | | | | | | | | | | |
| SEC 5 @ 4 credits (if offered as an option) | Mushroom Culture Technology | 24BOT201SE01 | 2 | 0 | 2 | 4 | 4 | 0 | 8 | 12 | 15 | 35 | 15 | 35 | 100 |
| SEMESTER VIII (2024-25) | | | | | | | | | | | | | | | |
| SEC 6 @ 4 credits (if offered as an option) | Floriculture | 24BOT202SE01 | 2 | 0 | 2 | 4 | 4 | 0 | 8 | 12 | 15 | 35 | 15 | 35 | 100 |

L: Lecture; T: Tutorial; P: Practical

SYLLABI FOR **SKILL ENHANCEMENT COURSE** BACHELOR OF SCIENCE (**Botany as Single Major**) WITH HONS. IN BOTANY

Semester –I (Session: 2024-25)

| | | | |
|-----------------------------|----------------------------------|-----------------------|----------------------------------|
| Name of Program | Bachelor of Science (Botany) | Program Code | USBT4 |
| Paper No. | Paper 4 (Theory) | Nomenclature | Biofertilizers and Biopesticides |
| Name of the Course | Skill Enhancement Course (SEC-1) | Course Code | 24BOT401SE01 |
| Hours per Week | 02 | Maximum Marks | 50 |
| Credits | 02 | Internal marks | 15 |
| Time of Examinations | 03 | External marks | 35 |

Note:

Examiner will set nine (09) questions and the candidates will be required to attempt five questions in all. Question number one (01) will be compulsory containing short answer type questions covering the entire syllabus from all units. Further, examiner will set two (02) questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Objectives:

To gain knowledge on eco-friendly fertilizers like *Rhizobium*, *Azospirillum*, *Azotobacter*, cyanobacteria and mycorrhizae, their identification, growth multiplication and practical application of organic farming and recycling of the organic waste. Knowledge of eco-friendly biopesticides.

Course Learning Outcomes (CLO):

CLO 1: Identify different microbes used as biofertilizers and biopesticides and also to understand the advantages and disadvantages of biofertilizers and biopesticides.

CLO 2: Acquire skills on isolation, culture of microbial agents, process of production and application of biofertilizers and biopesticides.

CLO 3: Evaluate the economic and environmental impacts of using biofertilizers and biopesticides.

CLO 4: Gain knowledge about the regulations on the production and use of biofertilizers and biopesticides.

Unit 1

Introduction to Biofertilizers: Biofertilizers: Definition, scope, status, and importance; Advantages and limitations of biofertilizers compared to chemical fertilizers, Types of biofertilizers (e.g. nitrogen-fixing, phosphate-solubilizing, plant growth promoting), Structure and characteristic features of bacterial (*Azospirillum*, *Azotobacter*, *Rhizobium*), actinomycetes (*Frankia*), cyanobacterial (*Anabaena*, *Nostoc*, *Hapalosiphon*) and fungal (AM and ectomycorrhiza) biofertilizers.

Unit 2

Production and applications of biofertilizers: Production of biofertilizers: Strain selection, sterilization, growth, equipment, fermentation (solid state and liquid), mass production of carrier based and liquid bio fertilizers, Factors affecting the production of biofertilizers (i.e., temperature, pH, aeration, carbon source); quality control of biofertilizers, Application methods and dosage of biofertilizers, Effect of biofertilizers on soil fertility, plant growth, and yield.

Unit 3

Commercialization and future prospects of biofertilizers: Biofertilizers -storage, shelf life, quality control and marketing; regulatory framework and certification for biofertilizers, Application technology for seeds, seedlings, tubers, sets etc.; factors influencing the efficacy of bio fertilizers, Economic feasibility and cost-benefit analysis of using biofertilizers, Future prospects and potential of biofertilizers in sustainable agriculture and environmental protection.

Unit 4

Biopesticides and applications: Biopesticides: Definition and classification; advantages and limitations of biopesticides compared to chemical pesticides. Modes of action and mechanisms of biopesticides, Characteristics and applications of microbial pesticides – bacteria, fungi and viruses, Characteristics and applications of botanical pesticides (plant extracts and essential oils) and biochemical (pheromones and repellents), Biocontrol agents (*Trichoderma* spp., *Pseudomonas* spp. and *Bacillus* spp) and their efficacy on seed borne and soil borne plant pathogens.

Semester –I (Session: 2024-25)

| | | | |
|-----------------------------|---|-----------------------|---|
| Name of Program | Bachelor of Science (Botany) | Program Code | USBT4 |
| Paper No. | Paper 4 (Practical) | Nomenclature | Biofertilizers and Biopesticides |
| Name of the Course | Skill Enhancement Course (SEC-1) | Course Code | 24BOT401SE01 |
| Hours per Week | 04 | Maximum Marks | 50 |
| Credits | 02 | Internal marks | 15 |
| Time of Examinations | 03 | External marks | 35 |

Note:**Course Objectives:**

To gain knowledge on eco-friendly fertilizers like *Rhizobium*, *Azospirillum*, *Azotobactor*, cyanobacteria and mycorrhizae, their identification, growth multiplication and practical application of organic farming and recycling of the organic waste. Knowledge of eco-friendly biopesticides.

Course Learning Outcomes (CLO):

CLO 1: Identify different microbes used as biofertilizers and biopesticides and also to understand the advantages and disadvantages of biofertilizers and biopesticides.

CLO 2: Acquire skills on isolation, culture of microbial agents, process of production and application of biofertilizers and biopesticides.

CLO 3: Evaluate the economic and environmental impacts of using biofertilizers and biopesticides.

CLO 4: Gain knowledge about the regulations on the production and use of biofertilizers and biopesticides.

List of Practical:

1. Nutritional media and their preparations.

2. Enumeration of microbial population in soil- bacteria, BGA, fungi, actinomycetes.
3. Methods of isolation and purification of microbial cultures.
4. Isolation of Rhizobium from legume root nodule.
5. Isolation of BGA from rhizosphere.
6. Isolation of Mycorrhiza.
7. Culture of *Trichoderma* spp., *Pseudomonas* spp. and *Bacillus* spp.
8. Quality control tests for biofertilizers, Biopesticides and bioagents.

Suggested student activities:

1. Collection of data on utilization of biofertilizers and biopesticides by farmers and conducting awareness campaign at farmers' fields.
2. Collection of literature on various biofertilizers, biopesticides and biocontrol agents.
3. Visits to production units of biofertilizers, biopesticides and biocontrol agents.
4. Case studies on efficacy of biofertilizers, biopesticides and biocontrol agents.
5. Report on mass production technologies of biofertilizers, biopesticides and biocontrol agents.
6. Case study on ill effects of chemical fertilizers and pesticides.

Pattern of Practical examination:

1. Identify the microbes A & B and write a brief note on it (5)
2. Experiment on quality control test of biofertilizers/ biopesticides or isolation of microbes used as biofertilizers or biopesticides (4)
3. Submission of project report on topic allotted to student (6)
4. Practical records (3)
5. Viva-voce (2)

References/Suggested readings:

1. Subba Rao, N.S. (1993) Biofertilizers in Agriculture and Forestry, Oxford and IBH. Publ. Co., New Delhi.
2. Das, A. C., & Mukherjee, A. K. (2019). Biofertilizers for sustainable agriculture: a review of principles, processes, and practices. Springer.
3. Sadasivam, S., & Manickam, A. (2018). Biofertilizers technology. Springer.
4. S. S. Gnanamanickam, (2011) Biopesticides: Pest Management and Regulation, CAB International, Wallingford, UK.
5. B.S. Bisht, J.S. Panwar, and V.P. Bhatt, (2016) Handbook of Microbial Biofertilizers, CRC Press, Boca Raton, FL.
6. Gupta, S., & Prasad, R. (2018). Microbial inoculants in sustainable agricultural productivity. Springer.

7. Akhtar, M. S., & Siddiqui, Z. A. (2018). Role of rhizobacteria in soil: interactions and mechanisms. Springer.
8. N. Amaran, N. Kumar, and A.K. Gupta, (2011) Handbook of Biofertilizers and Microbial
9. Pesticides, Springer Science & Business Media, New York, NY.
10. Opendar Koul and G.S. Dhaliwal, (2009) Biopesticides: State of the Art and Future
11. Opportunities, Springer Science & Business Media, New York, NY. Franklin R. Hall and Julius
12. J. Menn, (1999) Biopesticides: Use and Delivery, Humana Press, Totowa, NJ.

Semester –II (Session: 2024-25)

| | | | |
|-----------------------------|---|-----------------------|---------------------|
| Name of Program | Bachelor of Science (Botany) | Program Code | USBT4 |
| Paper No. | Paper 3 (Theory) | Nomenclature | Floriculture |
| Name of the Course | Skill Enhancement Course (SEC 2) | Course Code | 24BOT402SE01 |
| Hours per Week | 02 | Maximum Marks | 50 |
| Credits | 02 | Internal marks | 15 |
| Time of Examinations | 03 | External marks | 35 |

Note:

Examiner will set nine (09) questions and the candidates will be required to attempt five questions in all. Question number one (01) will be compulsory containing short answer type questions covering the entire syllabus from all units. Further, examiner will set two (02) questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Objectives: To have knowledge of gardening and cultivation of ornamental plants and knowledge of landscaping, soil condition.

Course Learning Outcomes (CLO):

After completing this course, the learner will be able to:

CLO 1: Students will be able to understand the importance and scope of floriculture, management of nursery and gardens, methods of plant propagation.

CLO 2: Students will develop a conceptual understanding of different types of ornamental plants.

CLO 3 : Students will gain knowledge about the various types of gardens and importance of landscaping.

CLO 4: Students will learn about commercial floriculture and cultivation of important cut flowers

Unit 1

Introduction: History of gardening; Importance and scope of floriculture and landscape gardening. Nursery Management and Routine Garden Operations: Sexual and vegetative methods of propagation; Soil sterilization; Seed sowing; Pricking; Planting and transplanting; Shading;

Stopping or pinching; Defoliation; Wintering; Mulching; Topiary; Role of plant growth regulators.

Unit 2

Ornamental Plants: Flowering annuals (*Petunia, Chrysanthemum*); perennials (Rose, China Rose); Divine vines (Money plant, Monstera); 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.

Unit 3

Principles of Garden Design and landscaping ideas; Features of a garden (Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Flower beds, Shrubbery, Borders, Water garden.

Unit 4

Commercial Floriculture: Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life; Cultivation of Important cut flowers (Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolous, Marigold, Rose, Liliium, Orchids).

Semester –II (Session: 2024-25)

| | | | |
|-----------------------------|---|-----------------------|---------------------|
| Name of Program | Bachelor of Science (Botany) | Program Code | USBT4 |
| Paper No. | Paper 3 (Practical) | Nomenclature | Floriculture |
| Name of the Course | Skill Enhancement Course (SEC 2) | Course Code | 24BOT402SE01 |
| Hours per Week | 04 | Maximum Marks | 50 |
| Credits | 02 | Internal marks | 15 |
| Time of Examinations | 03 | External marks | 35 |

Note:

Course Objectives: To have knowledge of gardening and cultivation of ornamental plants and knowledge of landscaping, soil condition.

Course Learning Outcomes (CLO):

After completing this course, the learner will be able to:

CLO 1: Students will be able to understand the importance and scope of floriculture, management of nursery and gardens, methods of plant propagation.

CLO 2: Students will develop a conceptual understanding of different types of ornamental plants.

CLO 3 : Students will gain knowledge about the various types of gardens and importance of landscaping.

CLO 4: Students will learn about commercial floriculture and cultivation of important cut flowers

List of 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 common ornamental 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.

Pattern of Practical examination

1. Identify the given flower/ plant A & B and write a short note on its cultivation. (10)
2. Demonstrate the activity on grafting/ cutting/ air layering (5)
3. Practical records (3)
4. Viva-voce (2)

References/Suggested readings:

1. Randhawa, G.S., Mukhopadhyay, A. (1986). Floriculture in India. New York, NY: Allied Publishers.
2. Adams, C., M. Early and J. Brrok (2011). Principles of Horticulture. Routledge, U.K.
3. A.K.Singh.2006. Flower crops, cultivation and management. New India publishing agency, Pitampura, New Delhi.
4. T.K. Bose, L.P. Yadav, P. Patil, P. Das and V.A. Partha Sarthy. 2003. Commercial
5. Flowers. Partha Sankar Basu, Nayaudyog, 206, Bidhan Sarani, Kolkata.
6. S.K. Bhattacharjee and L.C. De. 2003. Advanced Commercial Floriculture. Aavishkar Publishers,Distributors, Jaipur.
7. Dewasish Choudhary and Amal Mehta. 2010. Flower crops cultivation and management. Oxford book company Jaipur, India. Randhawa,
8. G.S. Amitabha Mukhopadhyay, 2004. Floriculture in India. Allied Publishers Pvt. Ltd.
9. Arora, J.S. 2006. Introductory Ornamental Horticulture. Kalyani Publishers, Ludhiana.
10. Bhattacharjee, S.K. Advanced Commercial Floriculture. Aavishkar Publishers Distributors, Jaipur.
11. Sheela, V.L. 2008. Flower for trade. New India Publishing Agency, Pitampura, New Delhi-110088.
12. Abhinov Kumar. 2000. Production Technology of Ornamental Crops, Medicinal Plants and Landscaping. Kalyani Publishers, New Delhi.