

Under Graduate Curriculum Framework

B.Sc. Botany

Level 5

Semester I

Nature of Course	Course Code	Course Title	Credit
Discipline Specific Major -I	BOT-DSM-111	Biodiversity Microbes Algae Fungi And Archegoniate (Th.)	4
	BOT-DSM -112	Biodiversity Microbes Algae Fungi And Archegoniate (Pr.)	2
Multi-Disciplinary Major	BOT -MDM-111	Environment Studies (Th.)	4
	BOT -MDM -112	Environment Studies (Pr.)	2
Ability Enhancement Course	BOT AEC-111	Landscaping & Garden Management (Th.)	3
	BOT -AEC-112	Landscaping & Garden Management (Pr.)	1
Skill Enhancement Course	BOT SEC-111	Mushroom Culture Technology(Th.)	3
	BOT -SEC-112	Mushroom Culture Technology (Pr.)	1

Total Credit - 20

Semester II

Nature of Course	Course Code	Course Title	Credit
Discipline Specific Major -I	BOT-DSM-211	Plant Taxonomy (Th.)	4
	BOT-DSM -212	Plant Taxonomy (Pr.)	2
Multi-Disciplinary Major	BOT-MDM-211	Plant Diversity and Human welfare (Th.)	4
	BOT-MDM -212	Plant Diversity and Human welfare (Pr.)	2
Ability Enhancement Course	BOT-AEC-211	Nursery And Gardening (Th.)	3
	BOT-AEC-212	Nursery And Gardening (Pr.)	1
Skill Enhancement Course	BOT-SEC-211	Biofertilizers (Th.)	3
	BOT-SEC-212	Biofertilizers (Pr.)	1

Total credit - 20

Exit credit - 40

DEPARTMENT OF BOTANY
DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR (M.P.)
(A CENTRAL UNIVERSITY)

B.Sc. Syllabus (2022-23)

Ist Semester

Theory

Nature of Course	Course Code	Course Title	Course Credit	Contact Hours	Marks
Discipline Specific Major-I	BOT-DSM-111	Biodiversity (Microbes, Algae, Fungi, and Archegoniate)	4	60	100

Course Objectives: The objective of the course is to understand the basic concept of lower plants such as Microbes Algae, Fungi, Bryophytes, Pteridophytes, and Gymnosperm.

Learning Outcomes-based Curriculum Framework (LOCF)

This course will help students:

- To understand the basic concept of microbes, their structure, and their economic importance.
- To understand the basic information about the algae and their distribution. General characteristics and their economic importance.
- To understand the basic information about fungi, and their ecological significance.
- To understand the basic characteristic of Bryophytes and their economic importance.
- To understand the basic characteristics and economic importance of Pteridophytes and Gymnosperms.

Course Content:

Unit 1: Microbes (10 Lectures)

Viruses – Discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV); Economic importance; Bacteria – Discovery, General characteristics, and cell structure; Reproduction, vegetative, asexual, and recombination (conjugation, transformation, and transduction); Economic importance.

Unit 2: Algae (12 Lectures)

General characteristics; Ecology and distribution; Range of thallus organization and reproduction; Classification of algae; Morphology and life-cycles of the following: *Nostoc*, *Chlamydomonas*, *Oedogonium*, *Vaucheria*, *Fucus*, *Polysiphonia*. Economic importance of algae

Unit 3: Fungi (12 Lectures)

Introduction: General characteristics, ecology and significance, range of thallus organization, cell wall composition, nutrition, reproduction and classification; True Fungi- General characteristics, ecology, and significance, life cycle of *Rhizopus* (Zygomycota), *Penicillium*, *Alternaria* (Ascomycota), *Puccinia*, *Agaricus* (Basidiomycota), Symbiotic Associations-

Lichens: General account, reproduction, and significance; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance.

Unit 4: Bryophytes (12 Lectures)

Unifying features of archegoniates, Transition to land habit, Alternation of generations. General characteristics, adaptations to land habit, Classification, Range of thallus organization. Classification (up to family), morphology, anatomy and reproduction of *Marchantia* and *Funaria*. (Developmental details not to be included). Ecology and economic importance of bryophytes with special mention of *Sphagnum*.

Unit 5: Pteridophytes & Gymnosperms (14 Lectures)

General characteristics, classification, early land plants (*Cooksonia* and *Rhynia*). Classification (up to family), morphology, anatomy and reproduction of *Selaginella*, *Equisetum* and *Pteris*. (Developmental details not to be included). Heterospory and seed habit, stelar evolution. Ecological and economical importance of Pteridophytes.

General characteristics, classification. Classification (up to family), morphology, anatomy and reproduction of *Cycas* and *Pinus*. Ecological and economical importance.

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B.Sc. Syllabus (2020-21)
Ist Semester
Practical

Nature of Course	Course Code	Course Title	Course Credit	Contact Hours	Marks
Discipline Specific Major-I	BOT-DSM-112	Biodiversity (Microbes, Algae, Fungi, and Archegoniate)	2	60	100

1. EMs/Models of viruses: T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic Cycle.
2. Types of Bacteria from temporary/permanent slides/photographs; EM bacterium; Binary Fission; Conjugation; Structure of root nodule.
3. Gram staining
4. Study of vegetative and reproductive structures of *Nostoc*, *Chlamydomonas* (electron micrographs), *Oedogonium*, *Vaucheria*, *Fucus**, and *Polysiphonia* through temporary preparations and permanent slides. (* *Fucus* - Specimen and permanent slides)
5. *Rhizopus* and *Penicillium*: Asexual stage from temporary mounts and sexual structures through permanent slides.
6. *Alternaria*: Specimens/photographs and tease mounts.
7. *Puccinia*: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; section/tease mounts of spores on Wheat and permanent slides of both the hosts.
8. *Agaricus*: Specimens of button stage and full grown mushroom; Sectioning of gills of *Agaricus*.
9. Lichens: Study of growth forms of lichens (crustose, foliose, and fruticose)
10. Mycorrhiza: Ecto-mycorrhiza and endo-mycorrhiza (Photographs)
11. ***Marchantia***: Morphology of thallus, w.m. rhizoids and scales, v.s. thallus through gemma cup, w.m. gemmae (all temporary slides), v.s. antheridiophore, archegoniophore, l.s. sporophyte (all permanent slides).
12. ***Funaria***- Morphology, w.m. leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, l.s. capsule and protonema.
13. ***Selaginella***- morphology, w.m. leaf with ligule, t.s. stem, w.m. strobilus, w.m. microsporophyll and megasporophyll (temporary slides), l.s. strobilus (permanent slide).
14. ***Equisetum***- morphology, t.s. internode, l.s. strobilus, t.s. strobilus, w.m. sporangiophore, w.m. spores (wet and dry) (temporary slides); t.s. rhizome (permanent slide).
15. ***Pteris***- morphology, t.s. rachis, v.s. sporophyll, w.m. sporangium, w.m. spores (temporary slides), t.s. rhizome, w.m. prothallus with sex organs and young sporophyte (permanent slide).

16. **Cycas**- morphology (coralloid roots, bulbil, leaf), t.s. coralloid root, t.s. rachis, v.s. leaflet, v.s. microsporophyll, w.m. spores (temporary slides), l.s. ovule, t.s. root (permanent slide).
17. **Pinus**- morphology (long and dwarf shoots, w.m. dwarf shoot, male and female), w.m. dwarf shoot, t.s. needle, t.s. stem, l.s./t.s. male cone, w.m. microsporophyll, w.m. microspores (temporary slides), l.s. female cone, t.l.s. & r.l.s. stem (permanent slide).

Essential Readings

1. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2nd edition.
2. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4th edition.
3. Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi, India.
4. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
5. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad.

Additional Readings

1. Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 10th edition.
2. Sethi, I.K. and Walia, S.K. (2011). Textbook of Fungi & Their Allies, MacMillan Publishers Pvt. Ltd., Delhi.
3. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R., (2005). Biology. Tata McGraw Hill, Delhi, India.
4. Lack and Evans (2014): Bios Instant Notes: Plant Biology. Taylor & Francis, New York.
5. Madigan (2008): Brock Biology of Microorganisms. Pearson International Edition, Benjamin Cummings, U.S.A.
6. Dwivedi, Lalit Kumar (2014). Handbook of Botany. DBS Imprints, New Delhi.
7. Bhattacharya (2016) Textbook of Botany. Medech.
8. Mauseth (2011) Botany: An Introduction to Plant Biology. Jones & Barlett Publishers.

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B.Sc. Syllabus (2022-23)

Ist Semester

Theory

Nature of Course	Course Code	Course Title	Course Credit	Contact Hours	Marks
Multi-Disciplinary Major	BOT-MDM-111	Environment Studies	4	60	100

Course Objective: The course will enable students to understand the importance of environment and waste management skills.

Learning Outcomes-based Curriculum Framework (LOCF)

This course will help students:

This course will help students:

- To understand the cause of pollution and control measures
- To understand plant biodiversity and conservation studies
- To understand the cause of climate change and its impacts
- To understand the concept of ecosystems and environmental impact assessment.
- To understand the concept of sustainable development, sustainability indicators, and ecosystem restoration.

Course Contents:

Unit I: Environmental pollution: Air, Water, and Soil: Kinds, sources quality parameters, effects, and control.

Unit II: Biodiversity and conservation: Levels of biodiversity, Distribution and regional patterns; Hypotheses for global patterns of distribution; Hot Spots of Biodiversity, Biodiversity Conservation; IUCN categories, strategies for conservation.

Unit III: Climate change: Greenhouse gases, global warming; Ozone layer and Ozone hole consequences of climate change.

Unit IV: Ecosystem stability: concept (resistance and resilience), Ecosystem services, ecological perturbation and their impact on plants and ecosystems, Environmental Impact Assessment (EIA)

Unit V: Ecosystem Management: Concept, sustainable development, Sustainability indicators, ecosystem restoration.

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Ist Semester

Practical

Nature of Course	Course Code	Course Title	Course Credit	Contact Hours	Marks
Multi-Disciplinary Major	BOT-MDM-112	Environment Studies	2	60	100

1. Sampling methods for different communities.
2. Determination of concentration of dominance
3. Determination of species richness
4. Calculation of diversity indices
5. Listing of local birds and seasonal variations
6. Classifying plant species into IUCN Red List Categories
7. Collection and preparation of herbarium/museum of plants
8. Field visits to different biodiversity hotspots in India
9. Physico-chemical analysis of air, water, and soil samples from polluted areas by standard methods.

Essential Readings:

1. J.S. Singh, S.P. Singh and S.R. Gupta: Ecology, Environment and Resource Conservation, Anamaya Pub, New Delhi (2008)
2. D. Miller-Dombois and H. Ellenberg: Aims and methods of vegetation ecology, Wiley N.Y. (1974)
3. E.P. Odum: Basic ecology W.B. Saunders, Philadelphia. (1983).
4. R.L. Smith : Ecology and Field Biology, Harper Collins College Pub. Inc. New York... (1996)
5. Curtis, J.T. and G. Cottam, Plant Ecology Work Book: Laboratory Field Reference Manual, Burgess Publishing Co Minnesota. (1956)
6. Daubenmire, R.F. Plant Communities. A text book of Plant ecology. Harper and Row New York. 300 p. (1968)
7. Mishra R. Ecology Work Book, Oxford and IBH Publishing Co. New Delhi. Pp 235. (1968)

Additional Readings

1. Mayers, N. R. A. Mittermeyer, C.G. Mittermeyer, G.A.B. da Fonseca and J. Kednt, (2000). Biodiversity hotspots for conservation priorities Nature.
 2. Odum, E.P.: Fundamental of Ecology, Natraj Publisher, Dehradun, 3rd edition (1971)
 3. Oosting, M.J.: An Introduction to Plant Ecology, 2nd Edition, W.H. Freeman, San Francisco. London (1956)
 4. Piper, C.S. Soil and Plant analysis (1966 reprint) Han publisher, Bombay (1936).
 5. Weaver, J.E. and E.F. Clements, Plants Ecology, McGraw Hill Book Co, New York and London (1938).
 6. Whittaker, R.H.: Communities and Ecosystems. 2nd edition MacMillan Publishing Co. New York (1975)
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B.Sc. Syllabus (2022-23)

Ist Semester

Theory

Nature of Course	Course Code	Course Title	Course Credit	Contact Hours	Marks
Ability Enhancement Course	BOT-AEC-111	Landscaping and Garden Management	2	60	100

Course objective: The importance of the course is to develop skills, entrepreneurship, and employability in the students

Learning Outcomes-based Curriculum Framework (LOCF)

This course will help students:

Upon the completion of the course the students:

- To design landscape for various gardens and can give consultancy
- To understand soil quality according to landscape so that proper plants can be planted accordingly also, learn how to manage plant diseases.
- To develop various bio-fertilizer and later on establish entrepreneurship.
- Understanding the modern tools of Garden management and learn how to do planting pruning, budding, and designing modern gardens, will generate employability.
- Will be able to establish a carrier as a floriculturist and can provide jobs to others also.

Course Contents:

Unit-I: Landscaping: Principle of elements, Garden features, and adornment, Garden designing, Bio-aesthetics planning, Role of plants and combating environmental pollution, types of garden

Unit-II: Garden Management: - Soil analysis, Physiochemical properties, Soil nutrient management, Types of soil, the role of soil for plant growth, and plant disease management.

Unit-III: Bio-fertilizers: - Farm yard manure (FYM), Vermicomposting, Organic manure, Green manure, Role of bacteria, the role of AM fungi, Bio-pesticides.

Unit- IV: Garden tools (Falcon). 1. Pruning secateurs, 2. Hedge sheer with steel handle and PVC grip, 3. Pruning saw 4. Sickle with wooden handle, 5. Budding grafting knife, 6. Weeding towel chrome coated small and large, 7. Cultivator head three prongs with wooden handle, 8. Weeder with wooden handle, 9. Weeding fork, 10. Plant lifter with wooden handle, 11. Garden rake with steel handle 12 and 16 teeth, 12. Hoe garden type and Dutch type, 13. Khurpa high carbon steel, steel handle with PVC grip (small, medium and long), 14. Tree pruner multi-angular long reach pruner, 15. Spade with wooden handle, 16. Lawn mower manual, 17. Lawn mower electric motor, and techniques:- Spacing, compartments (for different plant groups), seeding, budding, cutting, grafting, thickets, irrigation (Automated drip irrigation).

Unit- V: Floriculture: - History of Ornamental plants, Floriculture as carrier, Commercial floriculture, flowers & Industries, floriculture business competition, World scenario floriculture.

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Ist Semester

Practical

Nature of Course	Course Code	Course Title	Course Credit	Contact Hours	Marks
Ability Enhancement Course	BOT-AEC-112	Landscaping and Garden Management	1	60	100

Suggested Laboratory Exercises:

1. Analysis of physico-chemical properties of soil.
2. Isolation and Identification of bio-inoculants.
3. Nursery development & plant propagation.
 - a) Important component of nursery.
 - b) Important nursery operation.
 - c) Use of Green House Nursery production.
 - d) Propagation through seeds, Propagation through cutting, Propagation through layering, Propagation through budding, Propagation through grafting.

Essential Readings

1. Bose, T.K., Maiti, R.G., Phua, R.S. and Das, P. (2012) Floriculture and Landscaping NayaUdyog, Kolkata
2. Misra, R.L. and Misra, Sanyat (2012) Landscape and Gardening Additional Westville publishing house New Delhi.

Additional Readings

1. Singh Solaria Ajeet and Singh Salaria Babita (2010) A to Z Horticulture at Glance – III Publisher Intellects, New Delhi.
2. Patil, D.A. (2007) Origin of plant names, Daya publishing House New Delhi.
3. Flora of Madhya Pradesh (1997) Vol. I & II Botanical Survey of India.
4. Woodrow G. Marsha (2017): Gardening in India. Bio Green Books, New Delhi.

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B.Sc. Syllabus (2022-23)

Ist Semester

Theory

Nature of Course	Course Code	Course Title	Course Credit	Contact Hours	Marks
Skill Enhancement Course	BOT-SEC-111	Mushroom Culture Technology	2	60	100

Course Objectives: The major objective of the course is to develop skills in mushroom cultivation. It's learner become entrepreneur.

Learning Outcomes-based Curriculum Framework (LOCF)

This course will help students:

1. To understand the basic concept of mushroom diversity, history of cultivation. Types of edible mushroom of India
2. To learn cultivation techniques, preparation of infrastructure for mushroom cultivation. Preparation mushroom begs.
3. To learn media preparation spawn preparation mushroom beg preparation composting technology.
4. To learn post-harvest technologies. Storage production of by product and information regarding presence of bioactive compound.
5. To learn about preparation various food frase mushroom. Information regarding various centre sand potential of marketing in India and abroad.

Course Contents:

Unit 1: Introduction, history. Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms. Types of edible mushrooms available in India- *Volvarellavolvacea*, *Pleurotuscitrinopileatus*, *Agaricusbisporus*. **(5 Lectures)**

Unit 2: Cultivation Technology : Infrastructure: substrates (locally available) Polythene bag, vessels, Inoculation hook, inoculation loop, low-cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag. **(6 Lectures)**

Unit 3: 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. **(6 Lectures)**

Unit 4: Storage and nutrition: Short-term storage (Refrigeration - upto 24 hours) Long

term. Storage (canning, pickels, papads), drying, storage in salt solutions. Nutrition- Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content- Vitamins. **(8 Lectures)**

Unit 5: Food Preparation: Types of foods prepared from mushroom. Research Centres- National level and Regional level. Cost benefit it ratio - Marketing in India and abroad, Export Value. **(5 Lectures)**



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B.Sc. Syllabus (2022-23)

Ist Semester

Practical

Nature of Course	Course Code	Course Title	Course Credit	Contact Hours	Marks
Skill Enhancement Course	BOT-SEC-112	Mushroom Culture Technology	1	60	100

Suggested Laboratory Exercises:

1. Field survey for Mushrooms collection
2. Collection methods of Mushrooms
3. Identification for different types of mushrooms.
4. Spawn preparation.
5. Antioxidant activity of Mushroom.
6. Cultivation of *Pleurotus* species, *Agaricus* species and other *Ganoderma*.
7. Antimicrobial activity of mushrooms.
8. Measurement of fungal growth by linear determination and by mycelia weight determination.
9. Enzyme activity (lignin-degrading enzymes cellulase)
10. Solid state fermentation, liquid state fermentation.

Essential Readings

1. Pathak, V.N Yadav N and Gour, (2004) M Mushroom production and processing Technology. Agrobios Jhoddhpur
2. Sharma B.C and Sharma N.P (2013) Mushroom cultivation and users. Agrobios Jhoddhpur

Additional Readings

1. Tiwari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.
2. Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition, Vol. I & Vol. I
3. Vyas, D., 2016, Mushroom krishikaranevamvyavasikaranPub.Krishna computer and Printer, Sagar.
4. Vyas, D. (2017). Mushroom utpadanvkiNaveentamTakniki. Daya Publication New Delhi
5. Borkar, S.G.& Patil, N. (2016). Mushroom: A Nutritive Food and its Cultivation. Bio Green Books, New Delhi.

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B.Sc. Syllabus (2022-23)

II Semester

Theory

Nature of Course	Course Code	Course Title	Course Credit	Contact Hours	Marks
Discipline Specific Major-I	BOT-DSM-211	Plant Taxonomy	4	60	100

Course Objectives: The objective of the course is to understand the basic concept of plant taxonomy.

Course Learning Outcomes:

Upon the completion of the course the students will be able to:

1. Understand the terminology and history of taxonomy.
2. Understand the principles and rules of ICN and understand the basic concept of palynology, cytology, and phytochemistry in relation to taxonomy.
3. Understand the basic principles of Classification and identification
4. Understand the herbarium techniques.
5. Understand the morphological and floral characters of different families.

Course Contents:

Unit 1 : (a) Introduction

(10 Lectures)

History of taxonomy, taxonomic terminology, description of plants.

Unit 2 : Botanical Nomenclature

(10 Lectures)

(a) Principles and rules (ICN); ranks and names; binominal system, typification, author citation, valid publication, rejection of names, principle of priority and its limitations.

(b) Taxonomic evidences from palynology, cytology, phytochemistry, and molecular data.

Unit 3: Classification and Identification

(14 Lectures)

(a) Types of classification-artificial, natural and phylogenetic. Bentham and Hooker (upto series), Engler and Prantl (upto series)

(b) Taxonomic hierarchy.

Unit 4: Herbarium Techniques:

Functions of herbarium, important herbaria and Botanical gardens of the India and world, flora and its importance, monograph.

(10 Lectures)

Unit 5 : Morphological, Floral characters and Economics importance of following families :

(16 Lectures)

Ranunculaceae, Brassicaceae, Malvaceae, Fabaceae, Asteraceae, Euphorbiaceae, Poaceae.

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II Semester

Practical

Nature of Course	Course Code	Course Title	Course Credit	Contact Hours	Marks
Discipline Specific Major-I	BOT-DSM-212	Plant Taxonomy	2	60	100

Suggested Laboratory Exercises:

1. Study of vegetative and floral characters of the following families (Description, V.S. of flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification): Ranunculaceae, Brassicaceae, Malvaceae, Fabaceae, Asteraceae, Euphorbiaceae, Poaceae.
2. Field studies and phenology of local flora. Visits of Botanical Garden.
3. Collection of plants species and herbarium techniques.
4. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).

Essential Readings

1. Dikshit, A. Siddiqui, M.O. and Pathak, A 2016 Taxonomy of Angiosperm Basic concept, Molecular aspects and Future prospects, by Studerra Press, New Delhi.
2. Sharma, O.P. Plant Taxonomy 2009 Tata Mc Graw Hill, New Delhi.

Additional Readings

1. Simpson, M.G. (2006). *Plant Systematics*. Elsevier Academic Press, San Diego, CA, U.S.A.
2. Singh, G. (2012). *Plant Systematics: Theory and Practice*. Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition.
3. Singh, M.P. & Abb S.G. (2016). *Essentials of Plant Taxonomy and Ecology*, Bio Green Books, New Delhi.
4. Dwivedi, Lalit Kumar (2014). *Handbook of Botany*. DBS Imprints, New Delhi.
5. Bhattacharya (2016). *Textbook of Botany*. Scientific International Publishers, New Delhi.

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B.Sc. Syllabus (2022-23)

II Semester

Theory

Nature of Course	Course Code	Course Title	Course Credit	Contact Hours	Marks
Multi-Disciplinary Major	BOT-MDM-211	Plant Diversity and Human Welfare	4	60	100

Unit 1: Plant diversity and its scope: Genetic diversity, Species Diversity, Plant Diversity at the ecosystem level, agro-biodiversity and cultivated plant taxa. Values and uses of biodiversity: Ethical and aesthetic values, Precautionary principle, Methodologies for valuation, Uses of plants, Uses of microbes. **(6 Lectures)**

Unit 2: Loss of Biodiversity: Loss of genetic diversity, Loss of species diversity, Loss of ecosystem diversity, Loss of agro-biodiversity, Projected scenario for biodiversity loss. **(6 Lectures)**

Unit 3: Management of Plant Biodiversity: Organizations associated with biodiversity management - Methodology for execution - IUCN, UNEP, UNESCO, WWF, NBPGR; Biodiversity legislation and conservations, Biodiversity information management and communication. **(6 Lectures)**

Unit 4: Conservation of Biodiversity: Conservation of genetic diversity, species diversity and ecosystem diversity, *In situ* and *ex situ* conservation, Biodiversity awareness programs, Sustainable Development. **(6 Lectures)**

Unit 5: Role of plants in relation to Human Welfare: a) Importance of forestry and its utilization and commercial aspects, b) Avenue trees, c) Ornamental plants of India, d) Alcoholic beverages through ages. Fruits and nuts: Important fruit crops their commercial importance. Wood and its uses. **(6 Lectures)**

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II Semester

Practical

Nature of Course	Course Code	Course Title	Course Credit	Contact Hours	Marks
Multi-Disciplinary Major	BOT-MDM-212	Plant Diversity and Human Welfare	2	60	100

Suggested Laboratory Exercises:

- Preparation of Project

Essential Readings:

1. Krishnamurthy, K.V. (2004). An Advanced Text Book of Biodiversity- Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi
2. Conservation Biology: A primer from South Asia by Kamaljit S. Bawa, Richard B. Primack and Meera Anna Oommen, 2011. Universities Press (Ltd.), Hyderabad.
3. Essential of Conservation Biology by Richard B. Primack, 2002, Third Edition. Sinauer Associates, Inc, Massachusetts USA.
4. Biodiversity and Conservation by P. C. Joshi and Namita Joshi, 2004, A. P. H. Publishing Corporation, New Delhi.
5. Menta, C.(2016): Biodiversity Vol. I. ISBN Publishers, New Delhi.
6. Pullaiah, T.(2016): Biodiversity in India (Vol. 8). Bio Green Books, New Delhi.

Additional Readings:

1. Biological diversity: The coexistence of species on changing landscapes by Michael A. Huston, 1994, Cambridge University Press.
2. Principles of Conservation Biology by Gary K Meffeand C. Ronald Carroll, 1994, Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts USA.
3. Conservation Biology: The Science of Scarcity and Diversity, Edited by Michael E. Soule, 1986. Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts USA.
4. Biodiversity: Social and Ecological Perspectives by Vandana Shiva, 1992. Natraj Publishers, Dehra Dun.
5. Levin (2013): Encyclopedia of Biodiversity (7 Vol. Set) Elsevier Publishers.

DEPARTMENT OF BOTANY
DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR (M.P.)
(A CENTRAL UNIVERSITY)

B.Sc. Syllabus (2022-23)

II Semester

Theory

Nature of Course	Course Code	Course Title	Course Credit	Contact Hours	Marks
Ability Enhancement Course	BOT-AEC-211	Nursery and Gardening	2	60	100

Course Objectives: The major objective of the course is to develop skill related to nursery development and Gardening. This course help to develop entrepreneurship and generate employability

Course Learning Outcomes:

Upon the completion of the course the students:

1. To understand and learning about planning, landscaping for developing nursery through seeding transplanting and maintenance of the plants.
2. To learn about seed morphology texture, seed dormancy, seed storage, seed banking. Develop seed texting skills.
3. To understand and learn various skill of vegetative propagations layering cutting, pruning, selection treatment developing green houses, mist chamber.
4. To understand and develop gardening skill. Also learn how to develop various gardens landscape designing. Soil analysis disease management.
5. To understand and learn processes of saving. It also provides cultivation vegetable crops and their marketing skills.

Course Contents:

Unit 1: Nursery: definition, objectives and scope and building up of infrastructure for nursery, planning and seasonal activities - Planting - direct seeding and transplants. **(4 Lectures)**

Unit 2: 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. **(6 Lectures)**

Unit 3 :Vegetative propagation: air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings - Hardening of plants - green house - mist chamber, shed root, shade house and glass house. **(6 Lectures)**

Unit 4: Gardening: definition, objectives and scope - different types of gardening - landscape and home gardening - parks and its components - plant materials and design - computer applications in landscaping - Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting. **(8 Lectures)**

Unit 5: Sowing/raising of seeds and seedlings - Transplanting of seedlings - Study of cultivation of different vegetables: cabbage, brinjal, lady's finger, onion, garlic, tomatoes, and carrots - Storage and marketing procedures. **(6 Lectures)**

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II Semester

Theory

Nature of Course	Course Code	Course Title	Course Credit	Contact Hours	Marks
Ability Enhancement Course	BOT-AEC-212	Nursery and Gardening	1	60	100

Suggested Laboratory Exercises:

1. Nursery development & plant propagation.
2. Development of Important component of nursery.
3. Important nursery operation.
4. Use of Green House Nursery production.
5. Propagation through seeds, Propagation through cutting, Propagation through layering, Propagation through budding, Propagation through grafting.

Essential Readings

1. Saini, R.S., Kaushik, N., Kaushik, R.A. Godara N.R. (2012) Practical – Nursery production. Publisher Agrobios – Jodhpur.
2. Woodrow, G. Marsha (2017): Gardening in India. Bio Green Books, New Delhi.

Additional Readings

1. Misra Sanyat and Misra R.L.– (2013) Commercial Ornamental bulb Science West Valley Publishing house New Delhi
2. Das, P.C. (2006) Manures and Fertilizers, Kalyani Publishers New Delhi
3. Krishnakumar, V. & P.(2017): Organic Farming in Plantation Crops. Bio Green Books, New Delhi.
4. Swaminathan, C. (2017): Vrikshayurvedic Farming: The Traditional Indian Agriculture. Bio Green Books, New Delhi.

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B.Sc. Syllabus (2022-23)

II Semester

Theory

Nature of Course	Course Code	Course Title	Course Credit	Contact Hours	Marks
Skill Enhancement Course	BOT-SEC-211	Biofertilizers	3	60	100

Course Objectives: The objective of the course is to Develop skill about the understanding microbes and their role as biofertilizers and application in organic farming skills.

Course Learning Outcomes:

Upon the completion of the course the students will be able to:

1. To understand the learn techniques of microbial collection and their role as biofertilizers.
2. To understand and learn isolation techniques of *Azospirillum* and *Azotobacter* and their responses and thereafter mass multiplication for application”
3. To understand and learn about Cyanobacteria and Azolla and role as biofertilizers.
4. To understand and learn about Mycorrhizal association, type of Mycorrhiza and preparation of inoculum and its uses.
5. To develop skill bout various type of manure and their application.

Course Contents:

Unit 1 : General account about the microbes used as biofertilizer – Rhizobium – isolation, identification, mass multiplication, carrier based inoculants, Actinorrhizal symbiosis. **(4 Lectures)**

Unit 2: *Azospirillum*: isolation and mass multiplication – carrier based inoculant, associative effect of different microorganisms. *Azotobacter*: classification, characteristics – crop response to *Azotobacter*inoculum, maintenance and mass multiplication. **(8 Lectures)**

Unit 3 : Cyanobacteria (blue green algae), *Azolla* and *Anabaena azollae* association, nitrogen fixation, factors affecting growth, blue green algae and *Azolla* in rice cultivation. **(4 Lectures)**

Unit 4: Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants. **(8 Lectures)**

Unit 5: Organic farming – Green manuring and organic fertilizers, Recycling of bio-degradable municipal, agricultural and Industrial wastes – biocompost making methods, types and method of vermicomposting – field Application. **(6 Lectures)**

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II Semester

Practical

Nature of Course	Course Code	Course Title	Course Credit	Contact Hours	Marks
Skill Enhancement Course	BOT-SEC-212	Biofertilizers	1	60	100

Suggested Laboratory Exercises:

1. Isolation of Rhizobium from Leguminous Root Nodules
2. Azotobacter- Isolation, Identification and Mass Multiplication
3. Azospirillum- Isolation, Mass Multiplication and Carrier Based Inoculant Preparations:
4. Isolation of Blue Green Algae from Water and Soil Samples:
5. Isolation of Arbuscular Mycorrhizal Fungal (AMF) Spores from Soil

Essential Readings

1. Lakhsman, H.C. and Channabasara, A. (2014) Biofertilizers and Biopesticides Pointer Publisher Jaipur.
2. Deshmukh, A.M. (2003). Biofertilizer and Biopesticides A B D Publisher Jaipur.

Additional Readings

1. Das, P.C. (2006) Manures and Fertilizers, Kalyani Publishers New Delhi
2. KassemAlef and PaologNannipieri (1995)Methods in Applied Soil Microbiology and Biochemistry, Academic Press London.
3. Aggarwal, Ashok & K.(2017): Mycorrhizal Fungi. Boi Green Books, New Delhi.
4. Krishnakumar, V. & P.(2017): Organic Farming in Plantation Crops. Bio Green Books, New Delhi.
5. Mohandas, Sukhada (2016): Arbuscular Mycorrhizal Fungi in Fruit crop production. Bio Green Books, New Delhi