MURSHIDABAD UNIVERSITY

DEPARTMENT OF BOTANY

SYLLABUS FOR I & II SEMESTER BOTANY

UNDER GRADUATE (UG) PROGRAM
FRAMED ACCORDING TO NATIONAL EDUCATION POLICY (NEP), 2020

2025

BERHAMPORE, MURSHIDABAD

Four Years Undergraduate Programme in the subject of **BOTANY** as per **NEP-2020**

Following courses of study are prescribed for **1st and 2nd semesters:**

YEAR	SEMESTER	TYPE OF THE COURSE	TITLE OF THE COURSE	COURSE NO.	CREDITS (T-Theory P- Practical)
	CERTIFICATE COURSE IN BASIC BOTANY				
FIRST YEAR	FIRST	MAJOR (M)	DIVERSITY OF MICROBES, FUNGI AND PLANTS	BOT-M-T-101 & BOT-M-P-101	4 (3T + 1P)
		MINOR (Mi)	INTRODUCTION TO MICROBES, FUNGI AND PLANTS	BOT-Mi-T-101 & BOT-Mi-P-101	4 (3T + 1P)
		INTERDISCIPLINARY COURSE (IDC)/ MULTI DISCIPLINARY COURSE (MDC)	APPLIED PALYNOLOGY/ PLANT DIVERSITY	BOT-IDC-T-101 / BOT-MDC-T-101	3 (T)
		SKILL ENHANCEMENT COURSE (SEC)	PLANTS IN HUMAN WELFARE	BOT-SEC-T-101 & BOT-SEC-P-101	3 (2T + 1P)
		ABILITY ENHANCEMENT COURSE(AEC)			4 (T)
		VALUE ADDED COURSE (VAC)			2 (T)
					Total Credit- 20
	SECOND	MAJOR (M)	ECOLOGY AND CONSERVATION BIOLOGY	BOT-M-T-201 & BOT-M-P-201	4 (3T + 1P)
		MINOR (Mi)	INTRODUCTION TO MICROBES, FUNGI AND PLANTS	BOT-Mi-T-201 & BOT-Mi-P-201	4 (3T + 1P)
		INTERDISCIPLINARY COURSE (IDC)/ MULTI DISCIPLINARY COURSE (MDC)	APPLIED PALYNOLOGY/ PLANT DIVERSITY	BOT-IDC-T-201 / BOT-MDC-T-201	3 (T)
		SKILL ENHANCEMENT COURSE (SEC)	MUSHROOM CULTIVATION	BOT-SEC-T-201 & BOT-SEC-P-201	3 (2T + 1P)
		ABILITY ENHANCEMENT COURSE(AEC)			4 (T)
		VALUE ADDED COURSE (VAC)			2 (T)
		INTERNSHIP (ADDITIONAL FOR CERTIFICATE)			4(T)
					Total Credit- 20/24

N.B. Students can opt either IDC or MDC (IDC is only for the students of the department of Botany and MDC is for the students other than bioscience departments)

UG SEMESTER–I

DIVERSITY OF MICROBES, FUNGI AND PLANTS
(MAJOR COURSE)

[Theory (3 credits) + Practical (1 credit) – 60 + 20 = 80 marks]
Internal Assessment = 20 (15 internal assessment + 5 class attendance)
End Semester = 60 [40 (theory) + 20 (Practical)]

Course No. BOT-M-T-101

Unit I: Microbial Diversity:

- Microbes-Introduction and significance; hierarchical organization of microbes in living world; Whittaker's Five Kingdom and Cavalier-Smith's (1998) six Kingdom concept; economic importance.
- Viruses-Discovery, structure (Baltimore), general account of plant and animal viruses and bacteriophages, concept of lytic and lysogenic cycles.
- Bacteria-Discovery, general characteristics, cell structure, cell wall, growth and modes of reproduction.

Unit-II: Algal, Fungal and Lichen Diversity:

- Algae-Classification (Lee 2018), Distribution, habitat, thallus organization, cell structure, pigments and reserve food, general reproduction, life cycle patterns and economic importance (in brief).
- Fungi- Occurrence, general characteristics, cell structure, reproduction, life cycle and economic importance (in brief).
- Lichen-Morphology, types and reproduction; economic importance.
- Mycorrhiza-General account, types and significance.

Unit-III: Cryptogam Diversity:

- Bryophytes- Algal origin, occurrence, general characteristics of three bryophyte clades: Marchantiophyta, Anthocerotophyta and Bryophyta; Brief concept on Antithetic and Homologous theory, and Progressive and Regressive evolution; ecological and economic importance (in brief).
- Pteridophytes-General features, classification, affinity with bryophytes, occurrence and alternation of generations. Pteridophytes-Reproduction, life cycle and economic importance.

Unit-IV: Phanerogam Diversity:

- Gymnosperms-Distribution, classification, general characters, reproduction and life cycle; affinities and evolutionary significance; economic importance.
- Angiosperms- general features, APG classification, economic significance (in brief).

UG SEMESTER–I

DIVERSITY OF MICROBES, FUNGI AND PLANTS
(MAJOR COURSE)

Course No. BOT-M-P-101

Practicals:

1. Basic knowledge on light and electron microscopes, concept of magnification and resolution.
2. Gram staining in bacteria.
3. Study of diversity in thallus forms of algae: Cyanophyceae, Chlorophyceae and Xanthophyceae through temporary mounts, specimens or permanent slides.
4. Study of various types of fungi and lichens through temporary mounts or locally available specimens.
5. Study of various types of Bryophytes and Pteridophytes using live/ preserved specimens.
6. Study of various types of Gymnosperms and monocots and dicots with the help of specimens collected from local areas during field trips.
7. Electron micrographs/Models of viruses.

UG SEMESTER–I

INTRODUCTION TO MICROBES, FUNGI AND PLANTS
(MINOR COURSE)

[Theory (3 credits) + Practical (1 credit) – 60 + 20 = 80 marks]
Internal Assessment = 20 (15 internal assessment + 5 class attendance)
End Semester = 60 [40 (theory) + 20 (Practical)]

Course No. BOT-Mi-T-101

Unit-I: Microbiology:

- Microbes-Introduction and significance; Whittaker's Five Kingdom and Cavalier-Smith's (1998) six kingdom concept; economic importance.
- Viruses-Discovery, structure, general account of plant and animal viruses and bacteriophages, concept of lytic and lysogenic cycles.
- Bacteria-Discovery, general characteristics, cell structure and modes of reproduction.

Unit-II: Phycology & Mycology:

- Algae- General characters, distribution, habitat, thallus organization, life cycle and economic importance (in brief).
- Fungi- Occurrence, general characteristics, cell structure, reproduction, life cycle and economic importance (in brief).
- Lichen-Morphology, types and reproduction; economic importance.
- Mycorrhiza-General account, types and significance.

Unit-III: Bryology & Pteridology:

- Bryophytes- occurrence, thallus structure and general features, alternation of generations; reproduction and life cycle; ecological andeconomic importance (in brief).
- Pteridophytes-General features, affinity with bryophytes, occurrence and alternation ofgenerations, reproduction, life cycle and economic importance.

Unit-IV: Gymnosperms & Angiosperms:

- Gymnosperms- Classification, distribution, general characters, reproduction and life cycle, economic importance.
- Angiosperms- General features and reproduction, categorization into monocots and dicots; concept of APG classification, economic importance (in brief).

UG SEMESTER–I

INTRODUCTION TO MICROBES, FUNGI AND PLANTS
(MINOR COURSE)

Course No. BOT-Mi-P-101

Practicals:

1. Electron micrographs/Models of viruses.
2. Study from permanent slides/preserved specimens of algae (available specimens).
3. Study from permanent slides/preserved specimens of fungi (available specimens).
4. Lichens and Mycorrhiza (study from photographs).
5. Study from permanent slides/preserved specimens of bryophytes, pteridophytes and gymnosperms (available specimens).
6. Identification of locally available angiospermic taxa (family and generic level).

UG SEMESTER–I

APPLIED PALYNOLOGY

(INTERDISCIPLINARY COURSE)

(3 credits) – 60 marks
Internal Assessment = 15 (10 internal assessment + 5 class attendance)
End Semester = 45

Course No. BOT-IDC-T-101

1. **Palynology:** definition; morphology: unit, polarity, symmetry, shape, size, aperture, exine stratification and ornamentation (sculpturing); pollen and non-pollen palynomorphs (spores and phytoliths), types of phytoliths, NPC classification (Erdtman); pollen wall- sporopollenin; harmomegathic mechanism; Contribution of palynology to plant systematics.

2. **Applications:**
   a. Geopalynology: Basic concepts of palaeopalynology (definition, role of fossil spore/ pollen/ phytolith in vegetation and climate reconstruction).
   b. Archaeopalynology
   c. Copropalynology
   d. Neopalynology: Palynotaxonomy
   e. Latropalynology
   f. Pharmacopalynology- brief idea of pollen grains as source of food, medicine and cosmetics.
   g. Aeropalynology: basic mechanism of spore/pollen allergy (Type I hypersensitisation), common spore/pollen allergies, pollen calendar, aeroallergens-common pollen-allergy causing plants of India, trapping of airborne pollen grains- Rotorod and Burkard Volumetric Samplers.
   h. Forensic palynology: definition, sources of pollen as forensic evidence– soil, clothing and foot wear, vehicles, human bodies, animal fur, spider web, applications and limitations of forensic palynology;
   i. Pollination biology- types of pollination and pollinator groups.
   j. Melissopalynology- common Indian bee plants, types of honey, determination of botanical and geographical origin, unifloral/ bifloral/ multifloral, geographical origin, adulteration.

UG SEMESTER–I

PLANT DIVERSITY

(MULTIDISCIPLINARY COURSE)

(3 credits) – 60 marks
Internal Assessment = 15 (10 internal assessment + 5 class attendance)
End Semester = 45

Course No. BOT-MDC-T-101

Unit I: Microbes:

- Microbes-Introduction, concept and significance.
- Viruses-Discovery, structure, general account of plant and animal viruses and bacteriophages.
- Bacteria-Discovery, general characteristics and importance.

Unit-II: Algae & Fungi:

- Algae- General account and economic importance (in brief).
- Fungi- General account and economic importance (in brief).
- Lichen-General account and economic importance.
- Mycorrhiza-General account, types and significance.

Unit-III: Bryophytes & Pteridophytes:

- Bryophytes- General features; ecological andeconomic importance (in brief).
- Pteridophytes- General features and economic importance.

Unit-IV: Gymnosperms and Angiosperms:

- Gymnosperms- General features; ecological and economic importance (in brief).
- Angiosperms- General characteristics and economic importance.

UG SEMESTER–I

PLANTS IN HUMAN WELFARE

(SKILL ENHANCEMENT COURSE)

(3 credits) – 60 marks
Internal Assessment = 15 (10 internal assessment + 5 class attendance)
End Semester = 45 [30 (theory) + 15 (Practical)]

Course No. BOT-SEC-T-101

Unit-I: Introduction and scope of plant and microbe diversity:

Diversity of plants- genetic diversity, species diversity and wild taxa, agrobiodiversity and cultivated plant taxa, importance of microbes and plants in human welfare; causes of loss of plant diversity.

Unit-II: Conservation:

Principle of conservation, *in situ* and *ex situ* conservations; management of plant biodiversity: organizations associated with biodiversity management – CITES, CBD, IUCN, UNEP, UNESCO, WWF, FAO and NBPGR.

Unit-III: Plant resources in human welfare:

Importance of forestry: utilization and commercial aspects; avenue trees and their significance; ornamental plants in India; commercial importance of crops, fruits, nuts, spices and timber; different types of beverages; medicinal and aromatic plants.

UG SEMESTER–I

PLANTS IN HUMAN WELFARE

(SKILL ENHANCEMENT COURSE)

Course No. BOT-SEC-P-201

Practical:

1. Identification of some important microbes and plants - *Lactobacillus*, Yeast, *Penicillium notatum*, *Azadirachta indica*, *Andrographis paniculata* and *Adhatoda vasica*, *Aloe vera*.

2. Visit to botanical garden and herbarium; national park/sanctuaries/biosphere reserves.

UG SEMESTER–II

ECOLOGY AND CONSERVATION
(MAJOR COURSE)

[Theory (3 credits) + Practical (1 credit) – 60 + 20 = 80 marks]
Internal Assessment = 20 (15 internal assessment + 5 class attendance)
End Semester = 60 [40 (theory) + 20 (Practical)]

Course No. BOT-M-T-201

Unit-I: Introduction: Basic concept of ecology and ecological factors; plant adaptation in relation to water and salt (Hydrophytes, halophytes and xerophytes), light (Sciophytes and heliophytes).

Unit-II: Ecosystem: Types, structure, energy flow, trophic organization, food chains and food webs, ecological pyramids; biogeochemical cycles: cycling of carbon, nitrogen and phosphorous; habitat and niche, ecotone and edge effect, microclimate, ecads, ecotypes.

Unit-III: Population & Community: population: types and characteristics; community-characteristics and diversity (α, β, γ), ecological succession, climax community.

Unit-IV: Conservation of Biodiversity: Level of Biodiversity: genetic, species & ecosystem diversity, Endangered and Endemic species of India; Biodiversity hot spots- criteria, Indian hotspots, *In- situ* and *ex-situ* conservation, Causes of extinction, IUCN Red List categories, Seed banks, gene bank, Cryopreservation.

UG SEMESTER–II

ECOLOGY AND CONSERVATION
(MAJOR COURSE)

Course No. BOT-M-P-201

Practicals:

1. Study of community structure by quadrat method and determination of (i) Minimal size of the quadrat, (ii) Estimation of frequency, density and abundance (to be done during excursion/ field visit).
2. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, rain gauge and lux meter.
3. Determination of pH of water and analysis of soil samples for soil moisture, organic carbon and nitrogen (field study).
4. Study of ecological adaptations in hydrophytes, halophytes and xerophytes.

UG SEMESTER–II

INTRODUCTION TO MICROBES, FUNGI AND PLANTS
(MINOR COURSE)

[Theory (3 credits) + Practical (1 credit) – 60 + 20 = 80 marks]
Internal Assessment = 20 (15 internal assessment + 5 class attendance)
End Semester = 60 [40 (theory) + 20 (Practical)]

Course No. BOT-Mi-T- 201

Unit I: Microbiology:

- Microbes-Introduction and significance; Whittaker's Five Kingdom and Cavalier-Smith's (1998) six Kingdom concept; economic importance.
- Viruses-Discovery, structure, general account of plant and animal viruses and bacteriophages, concept of lytic and lysogenic cycles.
- Bacteria-Discovery, general characteristics, cell structure and modes of reproduction.

Unit-II: Phycology & Mycology:

- Algae- General characters, distribution, habitat, thallus organization, life cycle and economic importance (in brief).
- Fungi- Occurrence, general characteristics, cell structure, reproduction, life cycle and economic importance (in brief).
- Lichen-Morphology, types and reproduction; economic importance.
- Mycorrhiza-General account, types and significance.

Unit-III: Bryology & Pteridology:

- Bryophytes- occurrence, thallus structure and general features, alternation of generations; reproduction and life cycle; ecological andeconomic importance (in brief).
- Pteridophytes-General features, affinity with bryophytes, occurrence and alternation ofgenerations, reproduction, life cycle and economic importance.

Unit-IV: Gymnosperms & Angiosperms:

- Gymnosperms- Classification, distribution, general characters, reproduction and life cycle, economic importance.
- Angiosperms- General features and reproduction, categorization into monocots and dicots; concept of APG classification, economic importance (in brief).

UG SEMESTER–II

INTRODUCTION TO MICROBES, FUNGI AND PLANTS
(MINOR COURSE)

Course No. BOT-Mi-P-201

Practicals:

1. Electron micrographs/Models of viruses.
2. Study from permanent slides/preserved specimens of algae (available specimens).
3. Study from permanent slides/preserved specimens of fungi (available specimens).
4. Lichens and Mycorrhiza (study from photographs).
5. Study from permanent slides/preserved specimens of bryophytes, pteridophytes and gymnosperms (available specimens).
6. Identification of locally available angiospermic taxa (family and generic level).

UG SEMESTER–II

APPLIED PALYNOLOGY

(INTERDISCIPLINARY COURSE)

(3 credits) – 60 marks
Internal Assessment = 15 (10 internal assessment + 5 class attendance)
End Semester = 45

Course No. BOT-IDC-T-201

1. **Palynology:** definition; morphology: unit, polarity, symmetry, shape, size, aperture, exine stratification and ornamentation (sculpturing); pollen and non-pollen palynomorphs (spores and phytoliths), types of phytoliths, NPC classification (Erdtman); pollen wall- sporopollenin; harmomegathic mechanism; Contribution of palynology to plant systematics.
2. **Applications:**

a. Geopalynology: Basic concepts of palaeopalynology (definition, role of fossil spore/ pollen/ phytolith in vegetation and climate reconstruction).
b. Archaeopalynology
c. Copropalynology
d. Neopalynology: Palynotaxonomy
e. Latropalynology
f. Pharmacopalynology- brief idea of pollen grains as source of food, medicine and cosmetics.
g. Aeropalynology: basic mechanism of spore/pollen allergy (Type I hypersensitisation), common spore/pollen allergies, pollen calendar, aeroallergens-common pollen-allergy causing plants of India, trapping of airborne pollen grains- Rotorod and Burkard Volumetric Samplers.
h. Forensic palynology: definition, sources of pollen as forensic evidence– soil, clothing and foot wear, vehicles, human bodies, animal fur, spider web, applications and limitations of forensic palynology;
i. Pollination biology- types of pollination and pollinator groups.
j. Melissopalynology- common Indian bee plants, types of honey, determination of botanical and geographical origin, unifloral/ bifloral/ multifloral, geographical origin, adulteration.

UG SEMESTER–II

PLANT DIVERSITY

(MULTIDISCIPLINARY COURSE)

(3 credits) – 60 marks
Internal Assessment = 15 (10 internal assessment + 5 class attendance)
End Semester = 45

Course No. BOT-MDC-T-201

Unit I: Microbes:

- Microbes: introduction and significance; economic importance.
- Viruses: discovery, structure, general account of plant and animal viruses and bacteriophages.
- Bacteria: discovery and general characteristics.

Unit-II: Algae & Fungi:

- Algae: general account and economic importance (in brief).
- Fungi: general account and economic importance (in brief).
- Lichen: morphology, types and economic importance.
- Mycorrhiza: general account, types and significance.

Unit-III: Bryophytes & Pteridophytes:

- Bryophytes: general features; ecological andeconomic importance (in brief).
- Pteridophytes: general features and economic importance.

Unit-IV: Gymnosperms and Angiosperms:

- Gymnosperms: general features; ecological and economic importance (in brief).
- Angiosperms: general characteristics and economic importance.

UG SEMESTER–II

MUSHROOM CULTIVATION

(SKILL ENHANCEMENT COURSE)

(3 credits) – 60 marks
Internal Assessment = 15 (10 internal assessment + 5 class attendance)
End Semester = 45 [30 (theory) + 15 (Practical)]

Course No. BOT-SEC-T-201

Unit-I: General overview of mushrooms:

General account; edible and poisonous mushrooms; types of edible mushrooms available in India (with local emphasis)- *Volvariella volvacea, Agaricus bisporus, Lentinula edodes*, *Ganoderma* spp.; medicinal and nutritional value of edible mushrooms.

Unit-II: 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, preparation of Pure culture, media preparation, preparations of spawn, mushroom bed preparation; factors affecting the mushroom bed preparation- Low cost technology; composting technology in mushroom production; cultivation methods; short-term storage and long term storage; drying, storage in salt solutions.

Unit-III: Food preparation and nutritional value:

Food preparation of mushrooms; mushroom research centres- national level and regional level; cost benefit ratio; marketing in India and abroad; export value.

UG SEMESTER–II

MUSHROOM CULTIVATION

(SKILL ENHANCEMENT COURSE)

Course No. BOT-SEC-P-201

Practical:

1. Principle and functioning of instruments used for mushroom culture.
2. Preparation of various types of media.
3. Inoculation and isolation techniques.
4. Preparation of mushrooms beds.
5. Demonstration and skilled technique of spawning.