

DEPARTMENT OF BOTANY
DEBRAJ ROY COLLEGE (AUTONOMOUS)
Golaghat-785621



SYLLABUS FOR M.Sc. PROGRAMME
IN BOTANY

Effective from Academic Session 2024-2025

M.Sc. Botany Syllabus | 2024

Paper Code	Name of the paper	Internal Assessment	End-Sem Assessment	Total Marks	Teaching Hours/Week	Credits
First Semester						
BOTC101T	Diversity I (Algae, Fungi, Bryophytes)	40	60	100	4	4
BOTC101P	Practical: Algae, Fungi, Bryophytes	20	30	50	8	2
BOTC102T	Diversity II (Pteridophytes, Gymnosperm and Angiosperm)	40	60	100	4	4
BOTC102P	Practical: Pteridophytes, Gymnosperm and Angiosperm)	20	30	50	8	2
BOTC103T	Plant Ecology and Phytogeography	40	60	100	4	4
BOTC103P	Practical: Plant Ecology and Phytogeography	40	60	50	8	2
BOTC104T	Environmental Pollution and Conservation	20	30	50	4	2
Total		200	300	500		20
Second Semester						
Paper Code	Name of the paper	Internal Assessment	End-Sem Assessment	Total Marks	Teaching Hours/Week	Credits
BOTC201T	Cytogenetics , Plant Breeding & Evolution	40	60	100	5	4
BOTC201P	Practical: Cytogenetics , Plant Breeding & Evolution	20	30	50	8	2
BOTC202T	Microbiology and Plant Pathology	40	60	100	5	4
BOTC202P	Practical: Microbiology and Plant Pathology	20	30	50	8	2
BOTC203T	Plant Physiology and Biochemistry	40	60	100	5	4
BOTC203P	Practical: Plant Physiology and Biochemistry	20	30	50	8	2
BOTC204T	Biofertilizer and organic farming	20	30	50	4	2
Total		200	300	500		20

- GE and SEC as per regulations

Programme specific outcome: M. Sc. in Botany

Understand the diversity, life cycle pattern, phylogeny and economic values of Cryptogmic and Phanerogamic plants of the NE Region. Analyse the biotic and abiotic interactions in different ecosystems.

Understanding basic concepts and recent trends in Cytology, Genetics and Plant Breeding, Plant Physiology and Biochemistry, Microbiology, Plant Ecology, Mycology and Plant Pathology

Train up skill human resources in the field of Angiosperm Taxonomy. Perform procedures as per laboratory standards in the above mentioned areas.

Understand the application of plant resources in agriculture, health care, industry and other environmental issues.

FIRST SEMESTER**Allotment of Marks and Credits**

Paper(s)	Internal Assessment	End-Sem Assessment	Total	Credit	Class/week
BOT C101T	40	60	100	4	5
BOT C101P	20	30	50	2	9
BOT C102T	40	60	100	4	5
BOT C102P	20	30	50	2	9
BOT C103T	40	60	100	4	5
BOT C103P	20	30	50	2	9
BOT C104T	20	30	50	2	5
Total	200	300	500	20	
Examination Time:		Theory 3 (Three Hours)		Practical 5 (Five Hours)	

BOTC101T Diversity I (Algae, Fungi, Bryophytes)

Unit-I Algae: Diversity and classification, recent trends in the classification, pigmentation, morphology and reproduction, phylogeny and interrelationships among different groups, patterns of life cycle and post fertilization stages in Chlorophyta, Xanthophyta, Phaeophyta and Rhodophyta, Ecological importance in different habitats, Algal indicators, Algal blooms, Eutrophication, Productivity in fresh water and marine environment, symbiotic association, Algal culture.

Unit-II Fungi: Characteristics of fungi and cell structure, recent trends in classification and phylogeny, major groups and their interrelationships. Physiological and ecological specialization (coprophilous, cellulolytic, entomogenous and lignolytic); Mycorrhiza- types, mechanism of association and roles. Common parasites of plants and humans, Saprophytes - decomposition of organic matter. Different mode of reproduction, parasexuality and degeneration of sex in fungi, spore dispersal mechanism and economic importance.

Unit-III Fungi of Medical Interest : Mycoses ; Allergies of man and animal caused by fungi. Mycotoxins and Mycotoxicoses, with special reference to Aflatoxins and Ergot alkaloids.

Unit-IV : Myxomycetes : General characters, Classification and phylogeny. Structure, reproduction and lifecycle pattern. Role in biosphere.

Unit-IV Lichen: Classification and nomenclature, structure and reproduction, mechanism of phycobiont and mycobiont interaction, lichen as ecological indicator.

Unit-VI Bryophytes: Origin, evolution, classification, biochemistry, physiology and ecology; diversity and distribution in North East India, Morphological, anatomical and reproductive diversity, Morphogenesis, Evolution of gametophytes and sporophytes; Bryophytes as pollution indicator and monitoring, Economic importance.

BOTC 102T Diversity II (Pteridophytes, Gymnosperm and Angiosperm)

Unit-I Pteridophyta: Origin and evolution of Pteridophytes; Telome concept; stellar evolution; heterospory and origin of seed habit; classification of vascular cryptogams. Morphological, anatomical and reproductive diversity, soral evolution in ferns, gametophytic structure in eusporangiate and leptosporangiate forms and evolution of sex.

Unit-II Palaeobotany: Geological time scale, fossilization process, classification and nomenclature of fossil plants, techniques in studying fossils, fossils vs. evolution. General account of major fossil groups - Psilophytales, Zosterophyllales, Sphenophyllales, Calamitales, Coenopteridales.

Unit-III Gymnosperms: Classification and salient features of major taxa; characteristics, affinities and relationships of Ginkgoales, Coniferales, Taxales and Gnetales.

Unit-IV Morphology: Origin and evolution of Angiosperms; Inflorescence and flowers; Co-evolution of flower and pollinators; Morphology of stamens and carpels; staminodia; nectaries; types of ovaries, morphology of inferior ovary; placenta and placentation.

Unit-V

Angiosperms: Historical background of Plant Taxonomy; Concept of Pre Darwinian plant classification. Bentham and Hooker, Engler and Prantl and Hutchinson system and recent system of classifications (Takhtajan, APG 3); recent trends in Taxonomy; ICN- History, Principles and major rules of nomenclature, type concept, principles of priority and its limitation, effective and valid publication, author citation; plant collection and documentation; importance of botanical gardens and herbaria in taxonomic studies: important botanical gardens in India and abroad; Botanical Survey of India.

Unit-VI Morphology and floral characters of Magnoliaceae, Ranunculaceae, Euphorbiaceae, Lamiales, Asteraceae, Orchidaceae and Poaceae.

BOTC 103T Plant Ecology and Phytography

Unit –I The Environment- physical and biotic; Definition, principle and scope of ecology, ecological factors. Concept of habitat and nicheresource partitioning; character displacement.

Unit –II Abiotic Ecological factors- Rainfall, Light, temperature, wind,; soil- origin, formation, composition, physical, chemical and biological components, soil profile. Water, moisture, precipitation. Hydrological cycle, water in soil and water table.

Biotic interactions-Source of energy, autotrophy, heterotrophy, symbiosis, commensalism parasitism.

Unit –III

Characteristics of a population; population growth curves; population regulation; life history strategies (r and K selection). Community structure and attributes; levels of species diversity and its measurement; edges and ecotones. Methods of studying plant communities. Ecological succession- types; mechanisms; changes involved in succession; concept of climax.

Unit -IV Ecosystem ecology: ecosystem structure and function; flow of energy; primary productivity and its measurement; primary productivity of terrestrial and aquatic ecosystems of the world; biogeochemical cycles (carbon, nitrogen, phosphorus, sulphur); development of ecosystem; ecosystem stability-ecosystem resistance and resilience; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (freshwater, marine, estuarine).

Unit –V Biodiversity – concept, components and types; importance of biodiversity conservation, Principles and practices, different approaches for biodiversity conservation-In-situ and ex- situ conservation.

Unit -VI Dynamic phytogeography and its basic principles, theories and hypotheses, centre of origin of cultivated plants, plant migration, theory of tolerance, age and area hypothesis, concept of endemism, megacentres of endemism in India, endemic plants of India with special reference to N E India, phytogeographic regions of the world and India and their characteristic vegetations. Characteristic flora of N E India.

BOTC 104T: Environmental Pollution and Conservation

Unit I Environmental pollution: sources of air, soil and water pollution, parameters to assess the pollution level, effects of pollution on plants and ecosystems and pollution abatement; global environmental change: climate change: greenhouse gases (CO₂, CH₄, N₂O, CFCs: sources, trends and role), consequences of climate change, ozone depletion. Environmental Protection and Biodiversity Acts

Unit II Human impacts on forest ecosystems; soil erosion and its control; shifting cultivation and its ecological implications; coal mining problem of northeast India; eco-restoration of degraded ecosystems; environmental impact assessment (EIA).

BOTC 101P Practical Paper: Algae, Fungi & Bryophytes

1. Study of range of thallus organization and reproductive structures of algae with the help of suitable representatives of Chlorophyceae, Phaeophyceae, Rhodophyceae Myxophyceae.
2. Study of morphological, anatomical and reproductive features of some fungi (Ascomycetes, basidiomycetes, deuteromycetes) in Assam
5. Study of morphological and anatomical features of some lichens growing in Assam
6. Study of morphology, anatomy and reproductive structures of some important genera of Hepaticopsida, Anthocerotopsida, Bryopsida, available in NE India.

BOTC 102P Practical Paper: Pteridophytes & Gymnosperms, Angiosperms

1. Study of some important living and fossil members of major groups of Pteridophytes.
2. Study of morphological, anatomical and reproductive features of gymnosperms available in the region.
3. Study of Angiospermic plants with analytical drawings, botanical description and identification up to the rank of species
4. Study of special types of inflorescence, primitive and advance flowers, ovaries and fruits
5. Collection and preparation of herbarium specimens of common plants for familiarization of herbarium techniques.
6. Field study report.

BOTC 103P Practical Paper: Plant Ecology and Phytogeography

1. Determination of minimum size and number of quadrates necessary to study herbaceous communities
2. Determination of abundance, density, frequency, basal cover of plant communities by quadrat method.
3. Estimation of above ground and below ground biomass from unit area.
4. Effect of biotic disturbances on botanical composition.
5. Study of similarity between plant communities using index of similarity and dissimilarity.
6. Estimation of dissolved oxygen content in eutrophic and oligotrophic water samples.
7. Study on effects of effluents/contaminants on plant growth.
8. Morpho-anatomical adaptive features of hydrophytes and xerophytes.
9. Preparation of a map of India showing biogeographical zones.
10. To plot Biosphere Reserves/ Ramsar sites/ National Parks/Wildlife Sanctuaries located in different biogeographical zones of India in general and NE India in particular.

SECOND SEMESTER**Allotment of Marks and Credits**

Paper(s)	Internal Assessment	End-Sem Assessment	Total	Credit	Class/week
BOTC 201	40	60	100	4	5
BOTC 201P	20	30	50	2	9
BOTC 202	40	60	100	4	5
BOTC 202P	20	30	50	2	9
BOTC 203	40	60	100	4	5
BOTC 203P	20	30	50	2	9
BOTC 204	20	30	50	2	5
Total	200	300	500	20	
Examination Time:		Theory 3 (Three hours)		Practical 5 (Five Hours)	

BOTC201T Cytogenetics, Plant Breeding and Evolution

Unit -I Structural organization and function of intracellular organelles, cytoskeleton; structure of prokaryotic and eukaryotic chromosomes, centromeres and telomeres. specialized chromosomes, euchromatin and heterochromatin, cell division and cell cycle, regulation and control.

Unit-II Genome organization, genome size and C-value paradox, DNA packaging, unique and repetitive DNA, linkage, recombination and crossing over, linkage mapping. sex-linked inheritance, cytoplasmic inheritance.

Unit-III Transcriptional regulation in prokaryotes, operon system for lactose, tryptophan and arabinose metabolism; Molecular basis of mutation, spontaneous, reverse and suppressor mutations, transposable genetic elements.

Unit-IV DNA damage and repair; in born errors of metabolism, metabolic pathways, overview of the metabolic basis of inherited diseases. `

Unit-V Principle of plant breeding; distant hybridization their barrier and techniques for distant hybridization; back Cross methods of plant breeding; breeding for quantitative characters, handling of quantitative data, environmental effect on quantitative characters, estimation of heritability and genetic advance, Germplasm and its conservation.

Unit-VI Evolution, co evolution, Lamarckism, Darwinism, synthetic theory, Wiseman's theory, modern theory of evolution

BOTC 202T Microbiology and Plant Pathology

Unit-I Microbial diversity: 'Species' and 'Strain' concept in microbiology, ICN for virus, bacteria and other microbes, microbiome concept, ecological significance of microbes, microbiology of soil, air, water and milk.

Unit-II Microbial techniques: sterilization techniques, population estimation (direct spore count, CFU, spectrophotometric method), pure culture and visualization techniques, culture preservation and maintenance, taxonomic and functional characterization of microbes.

Unit-III Microbial genetics & Physiology: Mode of reproduction (vegetative, asexual & sexual), genetic recombination, mode of nutrition, growth conditions and nutritional requirements, different metabolic pathways (respiratory and photosynthetic).

Unit-IV Plant Pathology: Principles of plant pathology, mechanism of pathogenesis, symptomatology and epidemiology, host defence mechanism, causal organism and etiology of certain important plant diseases occurred in NE India especially diseases on Tea, Forest trees, horticultural plants.

Unit-V

Applied microbiology: Application of microbes in the field of agriculture, fermented foods and dairy products, industry and bio-waste management

Unit-VI Immunology: Innate and acquired immunity, antibodies, cells and tissues of the immune system, immune diseases, serological reactions and serodiagnostics, cancer biology,

BOTC203T Plant Physiology and Biochemistry

Unit-I Membrane structure and function: Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, membrane pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes. Biomolecules: their structures and functions: Carbohydrate, lipids, proteins.

Unit-II Solute transport and photo-assimilate translocation: uptake, transport and translocation of water, ions, solutes and macromolecules from soil, through cells, across membranes, through xylem and phloem; mechanisms of loading and unloading of photoassimilates.

Unit-III Enzymes: Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes; Protein synthesis and processing: Nitrate and ammonium assimilation; amino acid biosynthesis.

Unit-IV Photosynthesis: Light harvesting complexes; mechanisms of electron transport; photoprotective mechanisms; CO₂ fixation-C₃, C₄ and CAM pathways. Respiration and photorespiration: Citric acid cycle; plant mitochondrial electron transport and ATP synthesis; alternate oxidase; photorespiratory pathway.

Unit-V Plant hormones: Biosynthesis, storage, breakdown and transport; physiological effects and mechanisms of action.

Photobiology: Structure, function and mechanisms of action of phytochromes, cryptochromes. Photoperiodism and Dormancy.

Unit-VI The basic concepts of plant stress, their nature, factors, and Influence on Plant Metabolism, Plant responses to stress conditions. Resistance and mechanism of tolerance to Stress.

BOTC 204T Biofertilizer and Organic Farming

Unit-I General account about the microbes used as Biofertilizer. Characteristic features, isolation, identification and mass multiplication of Rhizobium, Azospirillum, Azotobacter, Cyanobacteria (blue green algae), and Anabaena azollae.

Unit II Nitrogen fixation, factors affecting growth, blue green algae and Azolla in rice cultivation. Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of AM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants.

Unit-III Organic farming – Green manuring and organic fertilizers, pesticides and herbicides. Recycling of biodegradable municipal, agricultural and Industrial wastes – biocompost making methods, types and method of vermicomposting – field application and cultural practices.

BOTC201P Practical Paper: Cytogenetics and Plant Breeding

1. Preparation of fixatives and stains used in cytological works, killing and fixing of tissue and organs and their preservative, use of pretreatment for chromosome spreading.
2. Study of mitosis by squash techniques using suitable stains like acetocarmine, acetoorcein, haematoxyline, fuelgen techniques etc. in plant materials (squash from root tips or shoot tips of common economic and crop plants).
3. Study of meiosis by smearing techniques using suitable stains. in plant materials (smear from PMC's of common economic and crop plants).
4. Floral biology study, techniques of emasculation, selfing and hybridization techniques.
5. Basic Palynology: pollen morphology, viability and germination.

BOTC 202P Practical Paper: Microbiology and Plant Pathology

1. Isolation and pure culture of microbes from soil, air and water
2. Identification and characterization of isolated pure cultures
3. Estimation of water quality
4. Identification and characterization of milk bacteria and nodule bacteria
5. Methylene blue reductase test for bacterial contamination of milk
6. Estimation of bacterial growth by spectrophotometric method and counting of cells
7. Effect of physical and chemical factors on growth of microbes
8. Study of plant pathogenic fungi from diseased specimens (symptoms, causal organism and their morphological & reproductive characters)
9. Spore measurement and camera lucida diagram

BOTC203P Practical Paper: Plant Physiology and Biochemistry

1. Preparation of normal, molar, molal and ppm solutions
2. Extraction of proteins from plant materials and estimation by Lowry's method using BSA standard curve.
3. Extraction of carbohydrates from plant materials and estimation of reducing and non reducing sugars.
4. Extraction of oil/fat from plant materials
5. Extraction of plant phenols and estimation of total phenols.
6. Extraction of chloroplast pigments and quantitative estimation; Determination of chlorophyll a/b ratio and total chlorophyll in C3, C4 and CAM plants.
7. Separation of amino acid mixture by thin layer / paper chromatography.
8. Determination of effect of CO₂ concentration on rate of photosynthesis.
9. Study on effect of ionic concentration on imbibitions.
10. Effect of light intensity on photosynthesis.
11. Estimation of RQ of different plant materials.