

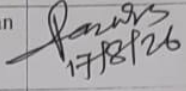
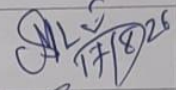
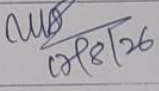
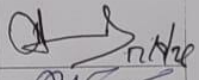
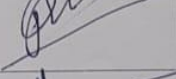
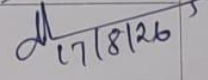
2026
BOTANY ONE YEAR POST GRADUATE PROGRAMME, 2026
BOTANY 2nd YEAR OF PG 2-YEARS PROGRAMME, 2026
Department of Botany
Rabindranath Thakur Vishwavidyalaya
Sir J. C. Bose Campus
Sagar Basti, Hojai, Assam, Pin-782435



**Integrated syllabus for 1-Year PG (Semester-I and II) and PG 2nd
Year of 2-Years PG (Semester-III and IV)**

FRAMED ACCORDING TO THE NATIONAL EDUCATION POLICY (NEP), 2020
Date of effect 17th August, 2026

Composition of Post Graduate Board of Studies (PG-BOS)
Rabindranath Thakur Vishwavidyalaya, Hojai, Assam
Meeting held on 17th August, 2026 at 2.00PM
Department of Botany

Sl. No.	Name & Designation	Deptt. & Institution	Address	Members	Signature
1.	Dr. Sushil Das Associate Professor & HOD	Botany Deptt. RTV	Hojai	Chairman	
2.	Dr. Faristha Yasmin Associate Professor & HOD	Botany Deptt. NU	Nagaon	External Member	
3.	Dr. Bhaben Tanti Professor & Ex HOD	Botany Deptt. GU	Guwahati	External Member	
4.	Dr. Monjit Saikia Associate Professor	Botany Deptt. RTV	Hojai	Member	
5.	Dr. Utpal Phukan Associate Professor	Botany Deptt. RTV	Hojai	Member	
6.	Dr. Nazim Forid Islam Associate Professor	Botany Deptt. RTV	Hojai	Member	
7.	Dr. Pranjal Morang Associate Professor	Botany Deptt. RTV	Hojai	Member	
8.	Dr. Dharmwantari L. Singha Asstt. Professor	Botany Deptt. RTV	Hojai	Member	

Composition of Post Graduate Board of Studies (PG-BOS)
Rabindranath Thakur Vishwavidyalaya, Hojai, Assam
Meeting held on 17th August, 2026 at 2.00PM
Department of Botany

Sl. No.	Name & Designation	Deptt. & Institution	Address	Members	Signature
1.	Dr. Sushil Das Associate Professor & HOD	Botany Deptt. RTV	Hojai	Chairman	
2.	Dr. Farisha Yasmin Associate Professor & HOD	Botany Deptt. NU	Nagaon	External Member	
3.	Dr. Bhaben Tanti Professor & Ex HOD	Botany Deptt. GU	Guwahati	External Member	
4.	Dr. Monjit Saikia Associate Professor	Botany Deptt. RTV	Hojai	Member	
5.	Dr. Utpal Phukan Associate Professor	Botany Deptt. RTV	Hojai	Member	
6.	Dr. Nazim Forid Islam Associate Professor	Botany Deptt. RTV	Hojai	Member	
7.	Dr. Pranjal Morang Associate Professor	Botany Deptt. RTV	Hojai	Member	
8.	Dr. Dhanwantari L. Singha Asstt. Professor	Botany Deptt. RTV	Hojai	Member	

**Integrated Course Structure for 1 Year PG (Sem-I & II) and 2nd Year (SEM-III & IV)
of 2-Years PG Programme (As Per NEP 2020)**

**Rabindranath Thakur Vishwavidyalaya, Hojai, Assam
Implemented from Academic Session 2026-2027**

Important Notes: -

1. **Though the course structure in integrated one, Students Completed 4th Year of FYUGP (8th Semester) shall be admitted to 9th Semester separately for PG programme on the basis of separate admission test with separate fee structure etc.**
2. **The course structure is integrated one, however, students completed three-year Degree Course shall be admitted to 7th semester separately of FYUGP which will be considered as 1st Semester of 2 Year PG programme. Separate admission test with separate fee structure etc. will be there for this programme.**
3. In case of FYUGP students opts to exit after completion of 1st year securing 40 credits shall be awarded UG certificate, if she/he completed one vocational course of 4 credits during summer vacation of first year.
4. In case of FYUGP students opts to exit after completion of 2nd year securing 80 credits she/he may be awarded UG Diploma certificate, if she/he completed one vocational course of 4 credits during summer vacation of second year.
5. Students opts to exit after completion of either 1st year or completion of 2nd year shall be allowed to re-enter within three years and complete the degree programme within the stipulated maximum period of seven years.
6. To get admission into 4th year of FYUGP, a student must have successfully completed all six semesters of the FYUGP and should not have any pending arrear paper.
7. To opt for "Honours with Research" in the 4th year, a student must have secured 7.5 or above CGPA upto 6th Semester.
8. For 4-years Honours Degree the core subject/discipline requires 80 credits and the minor subject/ discipline requires 32 credits. The students who exits after completion of 6th Semester / 3rd Year, she/he requires 60 credits in the core subject/discipline and 24 credits in the minor subject/ discipline.
9. IDC is completely independent of the Discipline Specific Core (DSC) and Discipline Specific Minor (DSM) courses. If a student studies a particular IDC course in the 1st semester, he/she will have to complete all 9 credit with same IDC.
10. In 3rd Semester students shall be allowed to change DSC making DSM as DSC and vice versa.
11. For AECC (MIL) students shall not be allowed to change subject in 4th Semester.
12. In case of single stream colleges IDC should be different from DSC and DSM.
13. For lateral exit after 2nd and 4th semester of FYUGP should complete extra 4 credit and submit application within one month of publication of results.
14. Students who intend to complete FYUGP will have two options in 7th and 8th semester as:

- i) Students who are selected for Honours with Research in 4th year are to study DSC-401, DSC-402, DSC-403, RM-401 and DSE-401 of 4 credits each in 7th semester. Accordingly, in 8th semester these students will study DSC-451 and DSE-451 of 4 credits each and to complete a dissertation /project DSR-452 of 12 credits.
 - ii) Students who will go for only Honours without Research will study DSC-452*, DSC-453*, DSC-454* mandatorily in lieu of dissertation/project in 8th semester in addition to DSC-451 and DSM-451.
15. Students who completed FYUGP with dissertation/project will be awarded Bachelor of Honours with Research. And students who completed four-year degree without dissertation/project will be awarded Bachelor Degree with Honours.
 16. For PG Programme FYUGP completed students will be admitted to 9th semester on the basis of of separate admission test. They will have three options in the 5th year.
 Option-I- PG by course work and Research.
 Option-II- PG by course work and
 Option-III- PG by research.
 Candidates completed Degree with Honours and Research naturally will opt either Option-1 or Option-III. They will opt either all theory papers of 9th semester and DSR-651 in 10th semester or only DSR-652 or only DSR-652 for both 9th and 10th Semester.
 17. In case a student completed FYUGP with Honours only without research likes to opt option I in PG programme, their DSR-651 shall have embedded RM in 10th Semester. Such option shall be strictly based on merit and availability of vacancy.
 18. Students who have completed only Honours in FYUGP without research shall not be allowed to opt option III in 5th year.

PROGRAMME OUTCOME OF 1 YEAR PG AND 2nd YEAR of 2-YEARS PG BOTANY
PROGRAMME AS PER NEP, 2020
Discipline Major/Core : BOTANY

By the end of the program the students will be able to deal with applications and sustainable utilization of natural resources for a harmonious global ecosystem. The programme learning outcomes have been formulated to ensure that students require strong basis in plant science and also developing a range of transferable skills and abilities that will equip them for a diverse range of professions and further studies.

- a) Gathering of knowledge on various life forms, life cycle and developmental process that exist among diversified plants.
- b) Understanding of mutual interactions among the various groups of plants and their role for the benefit of human being.
- c) Develop skill for the proper description by using botanical terminologies, identification, nomenclature and classification of life forms, particularly of plants and microorganisms.
- d) Understanding of major elements of variations that exist in the living world through comparative morpho-anatomical studies.
- e) Inculcate ability to explain biodiversity and evolution of life based on the empirical evidences in morphology, anatomy, embryology, physiology, Metabolism, taxonomy, Biochemistry, Phytochemistry, Pharmacognosy, Indian knowledge system, Conservation biology, plant ecology, Algology, Mycology, Pathology, Microbiology, Ecological conservation and management, biochemistry, life history of plants, Molecular biology, Biotechnology, cell biology, genetics, research methodology, Evolution and plant breeding.
- f) Development of skill for collection, preservation, analysis and recording of information after observation and critical analysis and to develop database up to molecular level.
- g) Awareness of the scientific and technological advancements, bioinformatics, biotechnology, biostatistics, GPS, GIS, mapping and global climate change for further learning and research in all branches of botany.
- h) Enable the graduates to prepare for national and international competitive examinations.
- i) Enable the graduates for practicing the best teaching pedagogy as botany teacher including the latest teaching digital modules.
- j) The graduate will be knowledgeable and competent enough to deliver appropriately the different aspects like ecology and environment, green technologies and organic agriculture etc.
- k) Graduate will be able to demonstrate proficiency in the hands-on experimental techniques for their area of specialization within biology during research and in professional career.
- l) Students will be capable of combining their understanding and skill with other disciplines and participating in multidisciplinary research and innovation.

Integrated syllabus of 1st Semester (For one-year PG) and 3rd Semester (For 2-years PG)

Sl No.	Paper Code	Paper	Paper Title	Credit	Hours	Classes
1.	DSC-601	1.1/3.1	Mycology and Plant Pathology	4	60	60
2.	DSC-602	1.2/3.2	Advanced Plant Physiology	4	60	60
3.	DSC-603	1.3/3.3	Phytochemistry and Pharmacognosy	4	60	60
4.	DSC-604	1.4/3.4	Genetics, Epigenetics, Plant Breeding & Evolution	4	60	60
5.	DSC-605	1.1/3.5	Microbial and Agricultural Ecology	4	60	60
6.	DSR-652	Research Paper	Dissertation in lieu of DSC total 10 theory papers in 9 th & 10 th Semester	40	600	

Total credit=20

DSC-601, DSC-602, DSC-603, DSC-604 and DSC-605 are not required for students who will opt DRS-652 in 9th and 10th Semester.

Integrated syllabus of 2nd Semester (For one-year PG) and 4th Semester (For 2 -years PG)

Sl No.	Paper Code	Paper	Paper Title	Credit	Hours	Class
1.	DSC-651	2.1/4.1	Plant Biotechnology and Immunology	4	60	60
2.	DSC-652	2.2/4.2	Plant Diversity (Algae, Bryophytes, Pteridophytes. Gymnosperms and Fossil	4	60	60
3.	DSC-653	2.3/4.3	Ecology and Environment	4	60	60
4.	DSC-654	2.4/4.4	Applied Microbiology	4	60	60
5.	DSC-655	2.1/4.1	Advanced Plant Taxonomy	4	60	60
			Total Credit	20		
6.	DSR-651	Research Paper	Dissertation in lieu of DSC total 5 theory papers in 10 th Semester	20	300	

DSR-651 (20) is in lieu of DSC-651, DSC-652, DSC-653, DSC-654 and DSC-655 for those students who will opt PG by Course work and Research. Students on exit shall be awarded Masters of Botany with Course work and Research or after securing the requisite 200 credits on completion of 10th semester. DSR-652 (40) is not offered by RTV at present.

DETAILED SYLLABUS OF POST GRADUATE PROGRAMME

Integrated syllabus of 1st Semester (For one-year PG) and 3rd Semester (For 2-years PG)

Title of the Course: Mycology & Plant Pathology

Course code: BOT-DSC-601

Nature of the Course: MAJOR/ CORE-1.1/3.1

Total Credits: 04

Distribution of Marks: 100: Theory-45, Practical-25, Internal assessment-30

Course objectives: Upon completion of the course, students will be able to: understand fungal diversity, taxonomy, and evolution; explain fungal physiology and molecular biology; identify economically important fungi; understand principles of plant pathology; diagnose plant diseases and their management; and perform laboratory isolation and identification of fungi.

UNITS	CONTENTS	L	T	P	Total Hours
Unit-I Marks:15	Diversity and Taxonomy of Fungi: General characteristics of fungi, Modern classification of fungi, Phylogeny and evolution, characters of different groups of fungi up to the generic level: (a) Myxomycota and (b) Eumycota- i) Mastigomycotina ii) Zygomycotina, iii) Ascomycotina, iv) Basidiomycotina, v) Deuteromycotina. Fungal nomenclature and identification	10	2		12
Unit- II Marks:15	Biology and Economic Importance of Fungi: Fungal cell structure, Nutrition and metabolism, Reproduction, Fungal genetics, Secondary metabolites, Industrial mycology, Mushroom cultivation, Mycorrhiza, Lichens, Beneficial fungi in agriculture, Mycotoxins	10	1		11
Unit-III Marks:15	Principles of Plant Pathology: Concept of plant disease, Disease triangle, Plant-pathogen interactions, Pathogenesis, Disease resistance, Host defence mechanisms, Disease development, Epidemiology, Disease forecasting, Molecular basis of pathogenicity, A brief idea of recognition concept and infection, symptomatology, Disease development: Role of enzymes, toxins, Phenolics, Phytoalexins, PR proteins and elicitors.	9	2		11
Unit-IV Marks:15	Plant Diseases and Disease Management: Major diseases of rice, Wheat, Maize, Potato, Tomato, Mustard, Tea, Citrus, and sugarcane Disease management: Cultural methods, Biological control, Chemical control, Resistant varieties, Integrated Disease Management (IDM), Plant quarantine, Recent advances in molecular diagnosis and disease management, Post-harvest diseases, Seed pathology, Genetics of resistance; 'R' genes.	10	1		11
Practical's Marks:25	1. Isolation of fungi from soil by the dilution plate method. 2. Isolation of fungi from infected plant tissues. 3. Pure culture techniques. 4. Preparation of different fungal media (PDA, Czapek Dox, MEA). 5. Microscopic study of fungal reproductive structures. 6. Identification of common fungal genera. 7. Study of mycorrhiza. 8. Disease diagnosis using symptoms and signs. 9. Herbarium preparation of diseased plant specimens. 10. Measurement of disease incidence and severity. 11. Demonstration of Koch's postulates. 12. Visit to plant pathology laboratory/farm and submission of report.			15	15

Total=60 classes

Mode of Internal Assessment: -1. Sessional examination-15 marks

2. Field trip, Excursion Tour, Seminar, quiz, Home assignment- 15 marks

DETAILED SYLLABUS OF POST GRADUATE PROGRAMME

Integrated syllabus of 1st Semester (For one-year PG) and 3rd Semester (For 2-years PG)

Title of the Course: Advanced Plant Physiology

Course code: BOT-DSC-602

Nature of the Course: MAJOR/ CORE-1.2/3.2

Total Credits: 04

Distribution of Marks: 100: Theory-45, Practical-25, Internal assessment-30

Course objectives: The objective of this course is to provide knowledge to the students on the molecular, biochemical, and cellular mechanisms underlying photosynthesis, respiration, mineral nutrition, water relations, and assimilate transport

UNITS	CONTENTS	L	T	P	Total Hours
Unit-I Marks:15	Plant Water Relations and Mineral Nutrition Water potential and its components; Aquaporins and membrane water transport; Stomatal structure & stomatal regulation, mechanism and significance of transpiration; Essential mineral nutrients; Nutrient sensing and signalling; Nitrogen uptake and assimilation; ABA-mediated drought signalling	5			5
Unit- II Marks:15	Advanced Photosynthesis and Carbon Metabolism Photosynthetic pigments and light harvesting complexes; Photosystems I & II; Regulation of photosynthesis under changing environments; Rubisco engineering and photorespiration; C3, C4, and CAM pathway; Carbon partitioning and source-sink relationships	9	1		10
Unit-III Marks:15	Plant Signalling Hormone biosynthesis, transport, and metabolism; Molecular mechanisms of hormone perception; Auxin signalling (TIR1/AFB pathway); Cytokinin signalling; Hormonal cross-talk in plant development and stress	13	2		15
Unit-IV Marks:15	Stress Physiology and Emerging Areas Drought, salinity, heat, and cold stress; Heavy metal toxicity; Oxidative stress and antioxidant defence system; Osmotic adjustment; Plant-microbe interactions; Climate change and plant adaptation; Plant metabolomics; Systems biology; Applications of plant physiology in sustainable agriculture	13	2		15
Practicals Marks:25	1.Determination of water potential using plasmolytic method. 2. Determination of Relative Water Content (RWC). 3. Measurement of transpiration by potometer. 4. Determination of stomatal index and stomatal frequency. 5. Determination of chlorophyll and carotenoid content. 6. Separation of photosynthetic pigments by paper/TLC chromatography. 7. Estimation of proline under stress conditions. 8. Preparation of a hydroponic nutrient solution (Hoagland's solution) and cultivation of leafy vegetables under hydroponic conditions			15	15

Total=60 classes

Mode of Internal Assessment: -1. Sessional examination-15 marks

2. Field trip, Excursion Tour, Seminar, quiz, Home assignment- 15 marks

DETAILED SYLLABUS OF POST GRADUATE PROGRAMME**Integrated syllabus of 1st Semester (For one-year PG) and 3rd Semester (For 2 -years PG)****Title of the Course: Phytochemistry and Pharmacognosy****Course code: BOT-DSC-603****Nature of the Course: MAJOR/ CORE-1.3/3.3****Total Credits: 04****Distribution of Marks: 100: Theory-45, Practical-25, Internal assessment-30**

Course objectives: The objective of this course is to provide knowledge to the students on various aspect of plant breeding, methods of crop improvement, quantitative inheritance, inbreeding depression and heterosis, crop improvement and breeding, biostatistics and evolution.

UNITS	CONTENTS	L	T	P	Total Hours
Unit-I Marks:15	Phytochemistry: Introduction and Definition, Importance and scope of phytochemical studies, Application of phytochemistry, Secondary metabolites and its classes.	5			5
Unit-II Marks:10	Extraction of phytochemicals, Different types of extraction methods, Solvent selection, Qualitative of analysis of active biomolecules, Fractionation and purification.	9	1		10
Unit-III Marks:10	Identification and characterization of phytochemicals, Detection of different classes of phytoconstituents by test tube and TLC method.	13	2		15
Unit-IV Marks:25	Pharmacognosy: Definition and scope of Pharmacognosy. Drugs and its different sources – plants and animals. Classification of drugs, cultivation, collection, processing and storage of natural drugs, Physical, chemical and biological properties of crude drugs. Basic metabolic pathways and formation of different secondary metabolites through Shikimic acid pathway and Acetate pathway. Principle and function of TLC, HPLC, LCMS, GCMS.	13	2		15
Practicals Marks:25	1. Working knowledge of TLC, HPLC, GCMS, LCMS and spectrophotometry. 2. Tests for identification of Alkaloids, Glycosides, Flavonoides, Tanins, Resin and volatile oils. 3. Preparation of extracts of crude drugs/ herbs by successive solvent extraction method. 4. Isolation and purification of – (a) Piperine from black pepper (b) Caffeine from tea powder. 5. Visit any phytochemistry lab / pharmacognosy industry/ crude drug preparation centre.			15	15

Total=60 classes

Mode of Internal Assessment: -1. Sessional examination-15 marks

2. Field trip, Excursion Tour, Seminar, quiz, Home assignment- 15 marks

DETAILED SYLLABUS OF POST GRADUATE PROGRAMME
Integrated syllabus of 1st Semester (For one-year PG) and 3rd Semester (For 2 -years PG)

Title of the Course: Genetics, Epigenetics, Plant breeding and Evolution

Course code: BOT-DSC-604

Nature of the Course: MAJOR/ CORE-1.4/3.4

Total Credits: 04

Distribution of Marks: 100: Theory-45, Practical-25, Internal assessment-30

Course objectives: The objective of this course is to provide knowledge to the students on various aspect of plant breeding, methods of crop improvement, quantitative inheritance, inbreeding depression and heterosis, crop improvement and breeding and evolution.

UNITS	CONTENTS	L	T	P	Total Hours
Unit-I Marks:10	Genetics:- DNA topology, ancient DNA switches and regulation of plant development, Cell free DNA (cfDNA/exDNA) definition, origin, occurrence in soil and others, physical and structural properties, Biological and practical importance and its extraction technique, QTL mapping using molecular marker	5			5
Unit- II Marks:15	Epigenetics: Definition and concept of epigenetics. Chromatin modification and their mechanism of action, Role of chromatin in gene expression and gene silencing, Types of histones, Histone modification through methylation, acetylation, phosphorylation and its effect on structure and function of chromatin, Heterochromatin formation and gene silencing. Future trends in Plant genetics and Breeding	9	1		10
Unit-III Marks:18	Plant breeding: - Introduction, history and Objectives. Breeding systems: modes of reproduction in crop plants. Centre of origin of cultivated plants, Plant introduction, acclimatization domestication of crop plants, quarantine, plant genetic resources, Important achievements and undesirable consequences of plant breeding. Methods of crop improvement: - Selection methods of crop improvement:- For self-pollinated, cross- pollinated and vegetative propagated plants viz. clonal selection, mass selection, pureline selection and their merits and demerits Hybridization:- For self, cross and vegetative propagated plants- hybridization procedure, advantages and limitations.	13	2		15
Unit-IV Marks:17	Quantitative inheritance: - Concept, mechanism, examples of inheritance of Kernel colour in wheat, skin colour in human beings. Monogenic vs polygenic inheritance. Inbreeding depression and heterosis:- History, genetic basis of inbreeding depression and heterosis and commercial application Crop improvement and breeding: - Role of polyploidy in crop improvement. Distant hybridization technique, barriers to the production of distant hybrids and its limitations Evolution, Co-evolution, Lamarckism, Darwinism, synthetic theory, Wiseman's theory and modern theory of evolution.	13	2		15

Practicals Marks:25	1. Extraction of cell free DNA (cf DNA) from sand/soil sample. 2. To demonstrate the procedure of germplasm collection. 3. To identify the seeds of economically important crop plants. 4. To determine the moisture content of seeds of various crops. 5. Viability test of pollen grain. 6. To study the procedures of emasculation and hybridization in self and cross pollinated crops. 7. To study the induction of polyploidy by colchicine treatment in crop plants.			15	15
--------------------------------	---	--	--	----	----

Total=60 classes

Mode of Internal Assessment: -1. Sessional examination-15 marks

2. Field trip, Excursion Tour, Seminar, quiz, Home assignment- 15 marks

DETAILED SYLLABUS OF POST GRADUATE PROGRAMME
Integrated syllabus of 1st Semester (For one-year PG) and 3rd Semester (For 2 -years PG)

Title of the Course: Microbial and Agricultural Ecology

Course code: BOT-DSC-605

Nature of the Course: MAJOR/ CORE-1.5/3.5

Total Credits: 04

Distribution of Marks: 100: Theory-45, Practical-25, Internal assessment-30

1. Course Objectives

- Provide advanced knowledge of soil as a dynamic ecological system and its physical, chemical and biological properties.
- Understand soil microbial diversity, ecology and interactions.
- Examine the role of microorganisms in nutrient cycling and maintenance of soil fertility.
- Develop knowledge of agricultural ecosystems and ecological principles underlying sustainable agriculture.
- Understand plant–soil–microbe interactions in agricultural productivity.
- Explore microbial technologies for sustainable soil and crop management.

2. Course Outcomes (CO)

CO1: Explain soil formation, properties and ecological processes occurring in soil.

CO2: Analyse the diversity, distribution and ecological functions of soil microorganisms.

CO3: Evaluate the role of microorganisms in biogeochemical cycling and soil fertility.

CO4: Understand agricultural ecosystems and interactions among crops, soil, microorganisms and environmental factors.

CO5: Assess sustainable agricultural practices, including biofertilizers and organic amendments.

CO6: Apply ecological and microbiological knowledge to address agricultural and environmental challenges.

UNITS	CONTENTS	L	T	P	Total Hours
Units-I Marks-15	Soil: Concept and Importance – Definition and significance of soil; soil as a natural and ecological system; soil functions in terrestrial ecosystems; soil as a habitat for organisms. Soil Formation – Weathering of rocks; physical, chemical and biological weathering; factors influencing soil formation; parent material, climate, topography, organisms and time. Soil Profile – Soil horizons and their characteristics; O, A, E, B and C horizons; soil profile development. Physical Properties of Soil – Soil texture, structure, bulk density, particle density, porosity, temperature, moisture and water-holding capacity. Chemical Properties of Soil – Soil pH, organic matter, cation exchange capacity, salinity, alkalinity and nutrient availability.	14	1		15
Unit-II Marks-15	MICROBIAL ECOLOGY AND SOIL MICROORGANISMS Introduction to Microbial Ecology: Concept, scope and significance of microbial ecology; microbial habitats and ecological niches; microbial diversity in soil. Major Groups of Soil Microorganisms: Bacteria, actinomycetes, fungi, algae and cyanobacteria, archaea and protozoa. Microbial Interactions: Mutualism, commensalism, competition, antagonism, parasitism and predation; microbial succession in soil. Environmental Factors Affecting Soil Microorganisms: Soil moisture, temperature, pH, organic matter, nutrient availability, aeration and agricultural practices. Rhizosphere, rhizoplane and phyllosphere; root exudates and microbial activity; plant–microbe interactions in the rhizosphere.	14	1		15

Unit-III Marks-15	MICROBIAL PROCESSES AND SOIL FERTILITY Soil Organic Matter Decomposition: Decomposition of plant residues; humification and mineralization; role of microorganisms in decomposition. Biogeochemical Cycles: Carbon, nitrogen, phosphorus and sulphur cycles. Biological Nitrogen Fixation: Free-living, associative and symbiotic nitrogen fixation; Rhizobium–legume symbiosis; actinorhizal symbiosis. Plant Growth-Promoting Microorganisms: PGPR and PGPF; mechanisms of plant growth promotion; phosphate solubilization; siderophore production; phytohormones; ACC deaminase activity. Mycorrhiza: Types of mycorrhiza; arbuscular mycorrhizal fungi; ectomycorrhiza; ecological and agricultural significance.	14	1		15
UNIT-IV Marks-15	AGRICULTURAL ECOLOGY AND SUSTAINABLE AGRICULTURE Concept of Agricultural Ecology: Definition, scope and principles of agroecology; agricultural ecosystem; structure and function of agroecosystems; natural ecosystem versus agroecosystem. Agroecosystem Components and Processes: Energy flow, food chains and food webs, nutrient cycling and ecological succession in agricultural systems. Sustainable Agriculture: Principles and practices; organic farming; integrated nutrient management; integrated pest management; conservation agriculture. Soil Health and Agricultural Sustainability: Soil health indicators; soil degradation; soil erosion; salinity and acidification; impacts of chemical fertilizers and pesticides on soil ecology. Climate-Smart and Ecological Agriculture: Climate change and agriculture; climate-resilient agriculture; biofertilizers and biopesticides; biochar and soil health; microbial technologies and agroecological approaches.	14	1		15
Practical Marks-25	1. Determination of soil texture by sedimentation method. 2. Determination of soil moisture content, water holding capacity, bulk density and soil pH 3. Determination of electrical conductivity of soil. 4. Estimation of soil organic carbon/organic matter. 5. Isolation of soil microorganisms using serial dilution and plating techniques. 6. Enumeration of bacteria, fungi and actinomycetes from soil. 7. Study of root nodules and nodulation in legumes. 8. Isolation and screening of phosphate-solubilizing microorganisms. 9. Screening of microorganisms for plant growth-promoting traits. 10. Demonstration of mycorrhizal association in plant roots. 11. Comparative study of soil microbial diversity under different land-use systems.				15

Total classes-60

Mode of Internal Assessment: -

1. Sessional examination-15 marks
2. Field trip, Excursion Tour, Seminar, quiz, Home assignment- 15 marks

TEACHING METHODS

Classroom lectures; interactive discussions; laboratory practicals; field-based learning (visit to an agricultural farm, organic farm or agricultural research station.) case studies; seminar presentations; group discussions; research article review.

SUGGESTED REFERENCES

1. Paul, E.A. Soil Microbiology, Ecology and Biochemistry.
2. Sylvia, D.M. et al. Principles and Applications of Soil Microbiology.
3. Alexander, M. Introduction to Soil Microbiology.
4. Brady, N.C. and Weil, R.R. The Nature and Properties of Soils.
5. Coleman, D.C., Callahan, M.A. and Crossley, D.A. Fundamentals of Soil Ecology.
6. Smith, S.E. and Read, D.J. Mycorrhizal Symbiosis.
7. Altieri, M.A. Agroecology: The Science of Sustainable Agriculture.
8. Gliessman, S.R. Agroecology: Ecological Processes in Sustainable Agriculture.
9. Subba Rao, N.S. Soil Microorganisms and Plant Growth.
10. Recent research articles from journals related to soil ecology, microbial ecology, agroecology and sustainable

DETAILED SYLLABUS OF POST GRADUATE PROGRAMME

Integrated syllabus of 2nd Semester (For one-year PG) and 4th Semester (For 2 -years PG)

Title of the Course: Plant Biotechnology and Plant Immunology

Course code: BOT- DSC-651

Nature of the Course: MAJOR/ CORE-2.1/4.1

Total Credits: 04

Distribution of Marks: 100: Theory-45, Practical-25, Internal assessment-30

Course objectives: The objective of this course is to provide knowledge to the students on plant biotechnology, including plant tissue culture, molecular biology, genetic engineering, and genome editing techniques, plant–pathogen interactions

UNITS	CONTENTS	L	T	P	Total Hours
Unit-I Marks:13	Plant Tissue Culture and Micropropagation- Introduction, scope and applications of plant biotechnology; Laboratory organization and aseptic techniques; Culture media and media preparation (MS medium); Plant tissue culture techniques; Callus culture, cell suspension culture, Meristem culture, anther culture; Somatic embryogenesis and synthetic seeds; Micropropagation; Application of plant tissue culture	5			5
Unit- II Marks:11	Molecular Biotechnology and Genome Editing- Plant genetic transformation (<i>Agrobacterium</i> -mediated and biolistic transfer methods); Selectable marker and reporter genes; PCR, RNA interference (RNAi); CRISPR/Cas9 based genome editing	9	1		10
Unit-III Marks:18	Plant Immunology- Overview of plant immune system; Pattern-Triggered Immunity (PTI); Effector-Triggered Immunity (ETI); PAMPs, PRRs and pathogen effectors; Hypersensitive response (HR); Gene-for-gene hypothesis; Systemic Acquired Resistance (SAR) and Induced Systemic Resistance (ISR); Plant microbiome and beneficial microorganisms	13	2		15
Unit-IV Marks:18	Applications in Crop Improvement and Disease Resistance• Development of transgenic crops; Disease-resistant crop development using biotechnology; Molecular diagnostics of plant pathogens; Phytoremediation and molecular farming; Secondary metabolite production; Biosafety regulations, intellectual property rights (IPR) and biosafety guidelines	13	2		15
Practicals Marks:25	1. Preparation of stock solutions and culture media (MS medium). 2. Sterilization techniques: autoclaving, filtration, and surface sterilization. 3. Callus induction from leaf, stem, or root explants. 4. Micropropagation of a selected medicinal or horticultural plant. 5. Isolation of genomic DNA from plant tissues. 6. Quantification and purity assessment of DNA (spectrophotometry/ Nano Drop). 7. Agarose gel electrophoresis of isolated DNA. 8. Plasmid isolation from bacterial culture.			15	15

Total=60 classes

Mode of Internal Assessment: -1. Sessional examination-15 marks

2. Field trip, Excursion Tour, Seminar, quiz, Home assignment- 15 marks

DETAILED SYLLABUS OF POST GRADUATE PROGRAMME

Common syllabus of 1st Semester (For one-year PG) and 3rd Semester (For 2 -years PG)

Title of the Course: Plant Diversity (Algae, Bryophytes, Pteridophytes, Gymnosperms & Palaeobotany)

Course code: BOT-DSC-652

Nature of the Course: MAJOR/ CORE-2.2/4.2

Total Credits: 04

Distribution of Marks: 100: Theory-45, Practical-25, Internal assessment-30

Course objectives: The objective of this course is to provide knowledge to the students on various aspect of plant diversity specially on advance knowledge on Algae, Bryophytes, Pteridophytes, Gymnosperms and fossil.

UNITS	CONTENTS	L	T	P	Total Hours
Unit-I Marks:7	Algae: Diversity & classification of algae, recent trends in classification, role of pigmentation in classification, phylogeny and interrelationship of among different groups of algae, Pattern of life cycles, morphology and reproduction and post fertilization changes/stages in Chlorophyta, Xanthophyta, Phaeophyta and Rhodophyta. Algae and environment, Ecology of algae, method of collection, method of preservation and preparation of slides, culture and cultivation of algae. Algae as food, industry, agriculture.	5			5
Unit- II Marks:17	Bryophytes: Theories of origin and evolution of bryophytes, biochemistry, physiology and ecology, diversity and distribution in north east India, Evolution of sporophytes and gametophytes, bryophytes as pollution indicator and monitoring, Morphological and reproductive diversity among different species of bryophytes such as Funaria. Sphagnum. Anthoceros	9	1		10
Unit-III Marks:18	Pteridophytes: Origin and evolution of pteridophytes, Telome theory, Stellar evolution, heterospory and origin of seed habit, morphology, anatomical and reproductive diversity among different species, Soral evolution of fern, gametophytic structure in eusporangiate and leptosporangiate fern, evolution of sex and economic importance. Prothallus.	13	2		15
Unit-IV Marks:18	Gymnosperms & Palaeobotany: Classification and salient features of major taxa, characteristics, affinities and relationship of Ginkgoales, Coniferales, taxales and Gnetales. Geological time scale, theories of fossilization process, classification and nomenclature of fossil, technique of fossil study. General account of Psilophytales, Zosterophytalles, Sphenophytalles, calamitales and Coenopteridales	13	2		15
Practicals Marks:25	1. Study of vegetative and reproductive parts of Helimida, Polysiphonia and Vaucheria. 2. Study of vegetative and reproductive parts of Anthoceros, Polytrichum. 3. Study of sorus structure of any Pteridophytes. 4. Study of vegetative and reproductive structure of Cycas and Gnetum. 5. Study of different types of fossil slides and stones with characters & classification. 6. Excursion tour to Research organization (other state)			15	,

Total=60 classes

Mode of Internal Assessment: -1. Sessional examination-15 marks

2. Field trip, Excursion Tour, Seminar, quiz, Home assignment- 15 marks

DETAILED SYLLABUS OF POST GRADUATE PROGRAMME
Integrated syllabus of 2nd Semester (For one-year PG) and 4th Semester (For 2 -years PG)

Title of the Course: Ecology and Environment

Course code: BOT-DSC-653

Nature of the Course: MAJOR/ CORE-2.3/4.3

Total Credits: 04

Distribution of Marks: 100: Theory-45, Practical-25, Internal assessment-30

Course objectives: The objective of this course is to provide knowledge to the students on various aspect of plant breeding, methods of crop improvement, quantitative inheritance, inbreeding depression and heterosis, crop improvement and breeding, biostatistics and evolution.

UNITS	CONTENTS	L	T	P	Total Hours
Unit-I Marks:12	Ecology & Ecosystem: Basic concept, Environmental factors, their interrelationship, Ecological Niche, habitat, limiting factors, Structure and functions of ecosystem, environmental pollution and threats to global ecosystem, pesticides and health hazards, Global climate change and different treaties.	5			5
Unit- II Marks:15	Plant population & community: Characteristics, carrying capacity, r-K selected population, Ecological amplitude, Adaptation, Methods of plant community study, Types and theories of plant Succession, Keystone and flagship species.	9	1		10
Unit-III Marks:18	Natural resources and conservation: Forest and wetland resources, Solar energy, Hydroelectric power generation, Dams and impacts, Wind energy, Soil types, degradation and management, Concept of integrated water management.	13	2		15
Unit-IV Marks:15	Modern tools and techniques of ecology: Concept and application of Remote sensing, GIS, GPS. Environmental Impact Assessment, Environment protection Acts. Concept of geography of earth.	13	2		15
Practicals Marks:25	1. Estimation of frequency and compare with Raunkiaer's normal frequency class (Raunkiaer's law of frequency). 2. Estimation of Importance value index in herbaceous community. 3. Phenological study of any plant community. 4. Determination of life-form and biological spectrum of any plant community. 5. Determination of DO and BOD in any aquatic body. 6. Determination of N, P, K and S in soil by rapid test method. 7. Visit to any ecologically important area to observe topography, climate and vegetation.			15	15

Total=60 classes

Mode of Internal Assessment: -1. Sessional examination-15 marks

2. Field trip, Excursion Tour, Seminar, quiz, Home assignment- 15 marks

DETAILED SYLLABUS OF POST GRADUATE PROGRAMME

Integrated syllabus of 2nd Semester (For one-year PG) and 4th Semester (For 2 -years PG)

Title of the Course: Applied Microbiology

Course code: BOT-DSC-654

Nature of the Course: MAJOR/ CORE-2.4/4.4

Total Credits: 04

Distribution of Marks: 100: Theory-45, Practical-25, Internal assessment-30

Course objectives: Understand the diversity, physiology, and applications of microorganisms, Explain the principles of industrial microbiology and fermentation technology, Apply microbiological techniques for the isolation, cultivation, and identification of microorganisms, Evaluate the role of microorganisms in agriculture, environmental management, and bioremediation, Understand the applications of microorganisms in food, medical, and molecular microbiology, Develop practical and research skills in applied microbiology.

UNITS	CONTENTS	L	T	P	Total Hours
Unit-I Marks:15	Microbial Diversity and Industrial Microbiology: Microbial diversity; structure of bacteria, a brief account of viruses, viroids, prions, mycoplasma, rickettsia and chlamydia. microbial growth kinetics; microbial nutrition; microbial culture techniques; industrially important bacteria, fungi, algae and actinomycetes; microbial enzymes and metabolites; strain improvement	11	1		12
Unit- II Marks:15	Microbial Biotechnology and Fermentation Technology: Principles of fermentation; fermenters and bioreactors; upstream and downstream processing; production of antibiotics, enzymes, vitamins, amino acids, organic acids, bioethanol and single-cell protein; quality control	10	1		11
Unit-III Marks:15	Environmental and Agricultural Microbiology: Soil microbiology; nitrogen fixation; phosphate solubilization; plant growth-promoting rhizobacteria (PGPR); biofertilizers; biopesticides; bioremediation; microbial degradation of pollutants; wastewater treatment; microbial biofilms, aeromicrobiology	9	2		11
Unit-IV Marks:15	Medical, Food and Molecular Microbiology: Food microbiology; food spoilage and preservation; probiotics; pathogenic microorganisms; biosafety; antimicrobial resistance; molecular diagnostic techniques (PCR, qPCR, ELISA); immunology, metagenomics; microbiome; recent advances in applied microbiology	10	1		11
Practicals Marks:25	1. Sterilization techniques and aseptic handling. 2. Preparation of microbiological media. 3. Isolation of microorganisms from soil, water and air. 4. Pure culture techniques and maintenance of cultures.			15	15

Total=60 classes

Mode of Internal Assessment: -1. Sessional examination-15 marks

2. Field trip, Excursion Tour, Seminar, quiz, Home assignment- 15 mark

DETAILED SYLLABUS OF POST GRADUATE PROGRAMME

Common syllabus of 2ndSemester (For one-year PG) and 4thSemester (For 2-years PG)

Title of the Course: Advanced Plant Taxonomy

Course code: BOT-DSC-655

Nature of the Course: MAJOR/ CORE-2.5/4.5

Total Credits: 04

Distribution of Marks : 100 (Theory-45, Practical-25, Internal assessment-30)

Course objectives: The objective of this course is to develop knowledge of understanding taxonomic concept, can solve various aspect taxonomic problems and research, develop the skill of identification taxa by using modern tools in this field.

UNITS	CONTENTS	L	T	P	Total Hours
Unit-I Marks:7	Basics of Taxonomy, Recent development of classificatory system in Angiosperms - APG System; Phenetic and Cladistic taxonomy.	4			4
Unit- II Marks:17	Modern Approach to Taxonomy: Molecular Approach in taxonomy, Diagnostic tools, Polymerase Chain Reaction (PCR) analysis, applications of molecular markers in plant taxonomy. Computers and taxonomy- Documentation and data processing. Molecular plant taxonomy scope, tools and techniques.	10	1		10
Unit-III Marks:18	Botanical Nomenclature: Principles and major rules, Typification, Effective and Valid Publication, Authors' Citation, Principles of Priority and Limitations, synonym, basionym, tautonym, homonym; nominaconservanda, rejection of names, illegitimate names. Plant Conservation: Endemism; IUCN; Endemic, Exotics and RET Plants of North-East India and their conservation. Plant Identification: Identification and Documentation; Construction of Botanical keys; Preparation of a flora.	13	2		13
Unit-IV Marks:18	Taxonomic Literatures: Flora, Manuals, Monograph, Revision, Icon, Periodicals. Herbaria and Botanical Gardens: Herbarium techniques; Roles of herbaria and botanical gardens, important herbaria and botanical gardens, Botanical Survey of India. Biosystematics: Methods, categories and importance; Role of computers in taxonomic studies, commonly available software. Phylogeny and Evolution of Angiospermic Taxa: Magnoliales, Euphorbiales, Lamiales, Asterales, Orchidales, Poales, Zingiberales.	13	2		13
Practicals Marks:25	1. Herbarium Preparation of locally available Angiosperm plants (20 nos). 2. Practices on Nomenclatural problems 3. Practices on identification of live/herbarium specimens/ molecular identification. 4. Online validation of nomenclature of collected plants.	20		15	20

Total=60 classes

Mode of Internal Assessment: -1. Sessional examination-15 marks

2. Field trip/Excursion Tour, Seminar, quiz, Home assignment- 15 marks
