



2023

North Lakhimpur College (Autonomous)

Ph. D. Course Work Syllabus (BOTANY)

Duration: 6months

There are five papers, Paper I, III, IV and V with 4 credits and Paper II with 2 credits.

Total credit:18

Marks Distribution and details of credits

Course	Course Code	Course Name	Credits	Type	Marks	IA	ES
Core Papers							
I	CW-4-BOT-101	Research Methodology	4	Theory	100	40	60
II	CW-2-BOT-102	Research and Publication Ethics	2	Theory	50	20	30
Elective Theory Paper [ Optional – I ] ( <b>any one</b> )							
III	CW-4-BOT-103	1.Environmental Studies 2. Research Techniques	4	Theory	100	40	60
Elective Theory Paper [ Optional – II ] ( <b>any one</b> )							
IV	CW-4-BOT-104	To be Prepared by the Supervisors	4	Theory	100	40	60
Compulsory Paper						Viva	Project
V	CW-4-BOT-105	Assignment/Project	4	-----	100	40	60
Total			18		450	180	270

## **Programme Objectives:**

- Provide students with knowledge, general competence, and analytical skills in Research Methodology and Research & Publication Ethics.
- To enable the students to strengthen their foundation for research in Botany and other related fields.
- To enable the students to critically analyse the findings of their research work.

## **Programme specific outcome:**

- Train up skilled human resources in different areas of plant sciences.
- Document the plant and microbial resources of NE Region of India and their application
- Analyse the issues of environmental contexts and sustainable development.
- Characterize the novel plant and microbes based bioactive components.
- Analyse the application of plant and microbial resources in agriculture, health care, industry and other environmental issues.
- Standardize protocol for analyzing and assessment of biodiversity of the NER India and their application

## **Core Paper – I : Research Methodology**

**Paper Code: CW-4-BOT-101**

**Marks = 60**

- Unit I:** Research methodology: Research concept, aims and objectives, motivation in research, criteria of good research, significance of research, problems encountered in research, Identification of research gap, Understanding the scientific questions, Novelty of research in support of existing literatures, setting hypothesis. 14
- Unit II:** Steps in Research: Types of research, Research methods and methodology, review of literature-definition, functions and importance of literature review, procedures of review of literature and common weakness, results or findings, discussion- purpose and importance of good discussion, writing research proposal/synopsis. 12
- Unit III:** Experimental designs: Formulation of research problem, sampling technique, methods selection, experimental set up, data generation/acquiring, Coding/decoding and reproducibility of data. 8
- Unit IV:** Data collection, analysis and interpretation: Fundamentals of data collection, primary and secondary data, biological significance of data, methods of collecting data, sample and sampling methods, classification of data, tabulation and presentation of data. 8
- Unit V:** Statistical analysis and data representation: SD, SE, Correlation and Regression, Test of significance, ANOVA, data validation, impact of small sampling size in data analysis, utility of computer/software (MS office, excel, power point, SPSS etc) in data analysis and presentation. 8
- Unit VI:** Scientific writings: Forms of scientific writing *i.e.* research articles, notes, reports, review, monograph, dissertation/thesis, popular article, etc. Components of research article, Writing strategy for a research article. 10

## **Core Paper – II: Research and Publication Ethics**

**Paper Code: CW-2-BOT- 102**

**Marks = 30**

### **Unit -I : Theory**

I : Philosophy and Ethics: a) Introduction to Philosophy: definition, nature and scope, concept, branches; b) Ethics: definition, moral philosophy, nature of moral judgements and reactions. 8

II : Scientific Conduct: a) Ethics with respect to science and research; b) Intellectual honesty and research integrity; c) Scientific misconducts: falsification, fabrication and Plagiarism (FFP); d) Redundant publications: duplicate and overlapping publications, salamislicing; e) Selective reporting and misrepresentation of data. 12

III : Publication Ethics: a) definition, introduction and importance; b) Violation of publications ethics, authorship and contributorship; c) Identification of publication misconduct, complaints and appeals; d) Predatory publishers and journals. 10

### **Unit -II : Practice:**

IV: Open Access Publishing: a) Open access publication and initiatives; b) SHERPA/RoMEO Online resource to check publisher copyright & self achieving policies; c) Software tool to identify predatory publications developed by SPPU; d) Journal finder/Journal suggestions tools viz. JANE, Elsevier Journal Finder, Springer Journal Finder.

V : Publication Misconduct: A. Group Discussion: i) Specific ethical issues, FPP, Authorship; ii) Conflicts of interests; iii) Complaints and appeals: examples and frauds in India and abroad. B. Software tools: i) Use of plagiarism software like: Turnitin, Urkund and other open source software tools.

VI : Database and Research Metrics: A. Databases: i) Indexing databases; ii) Citation databases: Web of Science and Scopus etc. B. Research Metrics: i) Impact Factor of Journal as per Journal citation report, SNIP, SJR, IPP, Cite Score; ii) Metrics: h-index, g index, i10 index, altmetrics.

## **Elective Theory (Optional - I) – II Environmental studies**

**Paper Code: CW-4-BOT-103(OPE)**

**Marks= 60**

**Unit I:** Definition of biodiversity; levels - microbial, genetic, species, ecosystem, landscape; drivers, magnitude and distribution of biodiversity; evolution of biodiversity; change in biodiversity over time in different regions of the world; concept of diversity hotspots; biodiversity in India: in the past and present; global distribution of biodiversity. 10

**Unit II:** Assessment and monitoring of biodiversity; Indicators for biodiversity; methodology of assessment and analysis of different species groups, monitoring of different species groups; importance of documentation and use of information technology in biodiversity study. 12

**Unit III:** Sustainable use of biodiversity; biodiversity loss and its consequences; Estimates of extinction rates worldwide and in India; biodiversity and food security; biodiversity and legal issues; Analyzing and discussion of causes and consequences of extinction/changes in biodiversity, North East Scenario. 10

**Unit IV:** Conservation strategies; conservation genetics; wildlife biology; ex -situ conservation: facilities, establishment of new populations, captive breeding, reintroduction, discussion on advantages and disadvantages; *in-situ* conservation: assessment of adequate areas, Impacts of climate change on natural ecosystems: forest, freshwater and marine aquatic systems, managed systems: agriculture, urban infrastructure, society; future climate projections; sea level rises and its impacts on natural systems. 14

**Unit V:** Recent developmental projects & environmental degradation with special reference to N.E. India, Need and necessity of EIA, Intellectual Property Rights issues in respect of: Conservation/ indigenous and traditional knowledge/ biotechnology/ technology transfer/ environmental sustainability, Practical applications of GIS, GPS and Remote Sensing. 14

## **Elective Theory (Optional - I) : Research Techniques**

**Paper Code: CW-4-BOT-103(OPR)**

**Marks = 60**

- Unit I:** Lab safety and lab practices: General lab safety measures, good laboratory practices, Biosafety measures (in case of burns, acid spills, injury), safety symbols, lab safety equipments, maintenance and handling of chemicals, Disinfectants, laboratory waste management, disposal of hazardous chemicals, radioactive and biological waste. 12
- Unit II:** Lab Equipments-use and its maintenance: Weighing balance, pH meter, magnetic stirrer, techniques of handling micropipettes, autoclave, vortex, laminar air flow, BOD incubator, shaker, micrometer, spectrophotometer, Agarose gel electrophoresis, centrifuge, distillation unit. 12
- Unit III:** Solutions and measurements: Molarity, Molality, Normality, Stock solution, standard solution, percent solution, dilution, pH, acids and bases, buffers – Tris-acetate, Tris-Cl, phosphate, Citrate buffer, Units of measurements and conversion from one unit to another, measurement of volumes of liquids, weighing, calculations. 12
- Unit IV:** Culturing and field techniques: Basic culture media - liquid and solid, culture techniques - plating (streak, spread and pour), serial dilution, Identification, collection, cataloguing, preservation techniques of specimens (Algae, Fungi, Higher Plants), herbarium, botanical keys. 12
- Unit V:** Basic knowledge on analytical techniques: Principle and application of IR and NMR Spectroscopy, Basic knowledge on separation techniques (Principle and application of Chromatography techniques, Gel filtration, GC, HPLC), Microscopy (Principle and application of Fluorescence, Confocal, SEM, TEM), use of fluorochromes, applications of fluorescence microscopy. 12

## **Elective Theory (Optional - II) : Plant Taxonomy**

**Paper Code: CW-4-BOT-104(OPT)**

**Marks= 60**

**Unit I:** Taxonomy and Systematics- Basic components of taxonomy, advancement levels of taxonomy; Digital databases of Plant Taxonomy; Post –Darwinian and APG systems of Classification.

**Unit II:** Phenetic Taxonomy- Principles, OTUs, taxonomic characters and their coding, Measuring resemblance (Simple matching coefficient, coefficient of association, Yule coefficient, taxonomic distance), Cluster analysis (Agglomerative methods, divisive methods, hierarchical classifications), ordinations, application of phenetic approaches in angiosperms.

**Unit III:** Cladistic Taxonomy- Cladistic Concepts (Plesiomorphic and apomorphic characters; homology and analogy; parallelism and convergence; monophyly, paraphyly and polyphyly, diagrammatic representation of phylogenetic relationships), OETs (Operational Evolutionary Units), Character and their coding, Measurement of similarity, Construction of cladograms, evaluating consensus tree.

**Unit IV:** Character concepts; Variation and Speciation- Phenotypic plasticity, types of variation, variance analysis, isolating mechanism, speciation, vicariance biogeography and endemism; exotic elements in India.

**Unit V:** Botanical Nomenclature- Principles of Nomenclature and codes; Names of taxa (genus, species, infraspecific categories); Rules of Priority and its limitation; Type concepts; Effective and Valid publication; author citation; names of hybrids, names of cultivated plants.

## **Elective Theory (Optional - II) : Genetics and Molecular biology**

**Paper Code: CW-4-BOT-104(OPG)**

**Marks= 60**

**Unit I:** Introduction: Tissue culture, historical perspective, techniques of tissue culture, composition of nutrient media, necessary requirements of tissue culture, totipotency, types of tissue culture

**Unit II:** Procedure for tissue culture: Selection of plant, collection of ex-plant, sterilization, preparation of culture medium, transfer to flasks, production of plantlets, hardening – primary and secondary hardening

**Unit III:** Applications of tissue culture: Importance of tissue culture in micropropagation, haploid production through androgenesis, triploid production, somatic embryogenesis, zygotic embryogenesis, artificial seeds, germplasm conservation, cryopreservation, production of virus free plants, protoplast isolation, culture and fusion, secondary metabolite production, somatic hybrids, somaclonal variation.

**Unit IV:** Basic computer skills for Biology: Introduction to Biological databases- features, classification, primary database (nucleic acid database, protein database, structure database), secondary database.

**Unit V:** Molecular techniques: Blotting techniques - Northern, Southern and Western Blotting, molecular DNA markers- RFLP, RAPD, SNPs, DNA sequencing, PCR.



## **Elective Theory (Optional - II) : Plant Ecology**

**Paper Code: CW-4-BOT-104(OPE)**

Marks= 60

**Unit I:** Field Survey, Field Sampling (Soil, Plant and Water Samples), Safety measures during field visit/trip, Food security, Self-care, Avoid in fields, Care from wild animals, Procedure for collection of hazardous samples, Hazard warnings, First Aid in the fields. Physicochemical analysis of Soil, Water and Plant samples, Overview of phyto-sociological methods used in ecological study.

**Unit II:** Laboratory Maintenance and Lab Safety Measures, Code of conduct - While entering in the lab, While working with the chemicals, Instruments, While disposal of chemicals, Storage and disposal of Chemical Wastes, Aqueous Wastes, Organic Wastes. Hazardous wastes and Broken Glass wares. How to perform experiments and recording of observations, Proper maintenance of data book, Basic biostatistics for ecological research.

**Unit III:** Degraded Ecosystem research in NE India-Current status and future direction, Use of algae, microbes and plants for remediation of degraded ecosystem, Stress Ecology- biotic and abiotic, Plant-animal and plant microbe interaction-key concept and methods of study.

**Unit IV:** Biological methods for treatment of waste water and solid waste, Biodegradation- key concept, understanding the pathways of biodegradation of xenobiotics, parent compounds, intermediate products and toxicity assay, bioaccumulation, bioremediation, phytoremediation, Ecological Risk Analysis.

**Compulsory Paper – III: Assignments/ Project work**

**Paper Code: CW-4-BOT-105**

**\*\*\*\*\*Projects/ Assignments to be conducted under respective supervisors.**

# **Ph. D. Course Work Syllabus (BOTANY)**

**(Effective from the academic session 2022 - 2023)**

Course structure and syllabus of Ph. D. course work in Botany approved by the Board of Studies in Botany on 29/04/2023, DRC of Botany on 04/05/2023 and Academic Council on 16/05/2023. The course work shall be of one semester. Students have to register themselves as per the prevailing guidelines of North Lakhimpur College (Autonomous)



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**Affiliated to Dibrugarh University**

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