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Pre-Ph.D. — BOTANY

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**Maharaja Suhel Dev State University**  
**Azamgarh, U.P.,**  
**276001**



**Syllabus of Pre Ph.D.-Course Work in Botany for University and Affiliated Colleges**

(As Per Guidelines of U.P Government in Accordance with  
National Education Policy-2020 with Effect from the session 2024-2025

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**Pre Ph.D.-Botany Course:** In Pre Ph.D., there shall be three compulsory papers (16 credits=6+6+4) and one **Non-credit** project work.

**Duration of course work will be of 6 months.**

The three papers will be as:

1. Two papers will be related to the concern subject. Each paper will be of 6 credits (6+6 credits =12 credits).
2. One paper will be of Research Methodology and computer application. This paper will be of 4 credits.

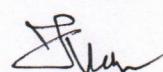
A minimum 55% marks or its equivalent CGPA will be the passing marks.

Those students, who will qualify in all the papers separately, will be given post graduate diploma in research.

- a. Regarding semester rules of the University, if a candidate fails to secure qualifying marks in a paper, may be given another chance, but the registration process will remain standby for such candidate.
- b. If a candidate secures 16 credits but fails to appear in the examinations or even filling up of the exam form, may be given an opportunity to appear in the next ensuing examinations, till then the process of registration will remain standby.
- c. The period of research apart from course work will be considered from the date of registration.

#### **Subject: Botany Titles and Code of the Paper for Pre-Ph.D.**

Course Code	Paper	Paper Title	Credits	Hours	Totalmarks
BOT-PhD-I	Paper 1	Research Methodology & Computer Applications	04	60	100
BOT-PhD-II	Paper 2	Tools & Techniques in Plant Sciences	06	60	100
BOT-PhD-III	Paper 3	Advances in Plant Sciences	06	60	100
	Paper 4	Project work	00		

## Paper1

## Research Methodology & Computer Applications

Course code: BOT-PhD-I

Total duration: 60 hours

**UNIT I:** Objective of research, Research problem and techniques involved in defining a problem, Types of research, Assessment of current status of topic chosen, Literature survey and reference collection, Formulation of hypothesis, Research design, Ethics in research, Code of ethics fabrication of data, Scientific misconducts: Falsification, Fabrication, Plagiarism (FFP),

12 hours

**UNIT II:** Types, sources, collection and tabulation of data, graphical representation, chi-square test, t- and F tests, ANOVA- One way and two way. **12 hours**

12 hours

**UNIT III:** Steps in writing report and research papers, layout of the research report, presentation of research (Abstract/Synopsis), Precautions in writing research reports, conclusions, Impact factor and Citation index. **12 hours**

12 hours

**UNIT IV: Publication ethics:** 1. Definition, introduction and importance 2. Best practices/standards setting initiatives and guidelines: COPE, WAME, etc. 3. Conflicts of interest 4. Publication misconduct: Definition, concept, problems that lead to unethical behaviors and vice versa, types 5. Violation of publication ethics, authorship and contributorship 6. Identification of publication misconduct, complaints and appeals.

### Research Metrics-

1. Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score Metrics: h-index, g-index, i10 index, altimetric. **12 hours**

12 hours

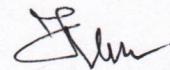
**UNIT V:** Computer and Internet: Networking, different WAN and LAN connections, Connection to a network, Web Browsers, Internet security, Web Search Engine, MS Word, Handling graphics, tables and charts, Converting a word document to various formats like- text, rich text, word perfect, html, pdf, etc. MS Power Point: creating slide show with animations, creating a blank presentation, screen lay out and views, insert a new slide, applying design template, changing slide layout, reordering and hiding slides, slide show and editing, custom slides.

12 Hours

12 hours

**References:**

Research Methodology: Methods and Techniques by C.R. Kothari, Second revised edition  
Research Methodology: A step-by-step guide for beginners by Ranjit Kumar  
Research methodology: Methods and Statistical techniques, by Santosh Gupta  
Statistical Methods, by S.P. Gupta  
Research Design, Qualitative, Quantitative and mixed method approaches, by W. Creswell, 3rd edition.  
Information Communication Technology, by Tim Shorts Handbook of Communication and Social Interaction Skills, by John O. Green, Brant Raney Burleson



Paper 2

Tools & Techniques in Plant Sciences

Course code: BOT PhD-II

Total duration: 60 hours

Unit I. Separation Techniques & Electrophoresis



**Chromatographic Technique:** Paper chromatography, Thin Layer Chromatography (TLC), High Performance Liquid Chromatography (HPLC), HPTLC, Gas -Liquid chromatography (GLC), Isoelectric Focusing.

**Electrophoresis:** PAGE, SDS PAGE, 1-D and 2-D gel electrophoresis, DIGE (Differential in Gel Electrophoresis). Separation of proteins through electrophoresis. Gel electrophoresis (AGE, 2D etc.), ChIP.

**Unit II. Microscopy & Microtomy** **12 hours**

**Microscopy:** Principles of Microscopy, Confocal microscopy, Fluorescence Microscopy, Electron Microscopy, Phase Contrast microscopy; Atomic Force Microscopy, Camera Lucida.

**Microtomy:** Microtomy/Microtome & its types: dehydration, clearing and embedding of material, section cutting, dewaxing. Different types of stains, their preparation and uses. **12 hours**

**Unit III. Spectroscopic Techniques:**

General principles; Basic laws of light absorption; Types of spectra and their biological usefulness. Principle, application and instrumentation of UV-VIS spectrophotometry; FTIR, Atomic Absorption spectrophotometry; Raman Spectroscopy, MALDI-TOF; GCMS.

**Unit IV Bioinformatics** **12 hours**

**Computational biology Techniques and Tools:** Techniques and tools for Sequences Alignment (Pairwise and multiple alignment), Phylogenetic analysis- Methods and Tools, gene prediction, ORF finding. **Homology:** Orthology & paralogy. **Databases:** NCBI, EMBL, DDBJ, Gene bank Online tools - BLAST, ORF finder, Primer3, protein motif and structure prediction tools.

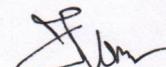
**Unit V. Techniques of Molecular Biology & Sequencing Whole genome sequencing:**

Whole genome shotgun sequencing; clone-by-clone or 'hierarchical shotgun' sequencing; pan genomes and metagenome.

**Next generation Sequencing Technologies:** Single-Molecule Real-Time (SMRT) Sequencing and Nanopore Sequencing; microbial genomes (including yeast); plant genomes (*Arabidopsis*, rice). Application of NGS. Genome editing tools ZFN, TALEN and CRISPR, Anti CRISPR; Genome annotation. **12 hours**

**References:**

- ❖ A Biology Guide to Principles and Techniques of Practical Biochemistry. 2000. Wilson, & Goulding, KH. ELBS edition.
- ❖ Cooper Robert and Hausman. The Cell: A Molecular Approach; 2013. Sinauer Associates, Inc.; 6 editions
- ❖ Introduction to Instrumental Analysis. Robert Brown. Mc Graw Hill International Edition.
- ❖ Introduction to Practical Molecular Biology. Dabre, PG. John Wiley & Sons Ltd.
- ❖ Kuby Immunology (sixth edition). 2006. Golds, RA. Thomas J. Kintz, Barbara, A. Osborne.

Freeman & Co., New York.

- ❖ Microbiological Applications: A Laboratory Manual in General Microbiology. Benson, H.J. WCG; WnCBrown Publishers.
- ❖ Microbiology, a Laboratory Manual. 2013. Cappuccino, JG and Sherman, N. Addison Wesley.



**Paper 3**  
**Advances in Plant Science**  
**Course code: Course code: BOT-PhD-III**

**Total duration: 60 hours**

**Unit I. Taxonomy & Nomenclature**

**Taxonomic & Nomenclatural products:** Botanical Congress and Plant nomenclature; **Taxonomic products:** Floras, Revisions, Keys, Monographs & synopses, Conspectus. **Taxonomic website for:** Names & Nomenclature, Literature and Herbarium Specimens. Description of new genus & species. **12 hours**

**Unit II. Biodiversity & Environment**

**Biodiversity:** Global environmental change & Biodiversity in India, Valuing biodiversity, Extinction & De-extinction, Vulnerability to extinction, Endemism. RET & IUCN. Concept of Rarity & NatureServe Conservation status assessment. Hot & cold spots; Biodiversity act. **12 hours**

**Unit III. Ecology**

**Ecology of Plant Invasion:** Invasion, invasion processes, hypothesis regarding invasion, success of invaders, Species invasiveness, invasive species in India, Management of invasive species, Seed bank studies.

**Restoration Ecology:** Phyto-sociological technique, Concept and strategies of ecological restoration, Ecology of disturbed ecosystems, Degradation and restoration of natural ecosystems. Soil sampling, Physico-chemical characteristics (Soil pH, Moisture, field capacity, bulk density, organic carbon, total nitrogen, available phosphorus, exchangeable Na, K, Ca). **12 hours**

**Unit IV. Phycology**

Taxonomic advancement in various groups of algae and their molecular phylogeny. Features of model organisms from cyanobacteria (*Synechocystis* sp. *Nostoc* sp. and algae (*Chlamydomonas reinhardtii*)). Retrieval of data and their bioinformatic analysis.

Metabolic engineering in microalgae: Algal cell as a bio-factory, Concept of transcriptome and metabolome. **12 hours**

**Unit V. Fungi & Diseases**

Molecular systematics of Fungi; modern tools for identification. Plant- microbe interactions: molecular basis of plant-fungal, and bacterial pathogen- plant interactions, virulence factor, host resistance and plant immunity; Yeast as a eukaryotic model organism: mutant creation and characterization, yeast vectors. **12 hours**

### References:

1. Chapman, V.J. and Chapman D.J., (1975). The algae. 2nd Edition, Mac. Millan Publ. Inc. New York.
2. Desikachary, T.V., (1959). Cyanophyta. ICAR, New Delhi.
3. Hoek, C. van den. Mann, D. G. and Jahns, H. M., (1995). Algae: An introduction to Phycology. Cambridge University Press, UK.
4. Prescott, G. W., (1969). The algae: A review. Nelson, London.
5. Round, F.E., (1981). The Ecology of Algae. Cambridge University Press, Cambridge.
6. Barry G. Hall. (2007). Phylogenetic Trees Made Easy: A How-To Manual, Third Edition. Sinauer Associates, Inc., Publishers, Sunderland, USA.
7. Christenhusz, M. J. M., Chase, M. W. and Michael F. F. (2017). Plants of the World: An Illustrated Encyclopedia of Vascular Plants. University of Chicago Press.
8. Angiosperm Phylogeny Group, (2016). An update of the Angiosperm Phylogeny Group Classification for the orders and families of flowering plants: APG IV. Botanical Journal of the Linnaean Society, 181: 1-20.
9. Cronquist, A. (1968). The Evolution and Classification of Flowering Plants. Houghton Mifflin. Boston.
10. Davis, P.H., & Heywood V. H. (1965). Principles of Angiosperm Taxonomy. Oliver & Boyd. Edinburgh.
11. Hutchinson, J. (1973). The Families of Flowering Plants. 3rd Edition. Oxford University Press. Oxford.
12. Jain, S.K. & Rao R. R. (1977). A Handbook of Field and Herbarium Methods. Today and Tomorrow's Printers and Publishers, New Delhi.
13. Jones, S.B., & Luchsinger, A.E. (1987). Plant Systematics. 2nd Edition. McGraw-Hill Book Company. New York.
14. Alexopoulos, C.J., Mims, C.W. and Blackwell, M., (2007). Introductory Mycology. Fourth Edition, Wiley India Pvt. Limited.
15. Mehrotra, R.S., (2017). Plant Pathology. 3rd Edition, McGraw-Hill Education, New Delhi.
16. Okafor, N. and Okeke, B.C., (2018). Modern Industrial Microbiology and Biotechnology. 2<sup>nd</sup> Edition, CRC Press, Boca Raton
17. Ethi, I.K. and Walia, S.K., (2018). Text book of Fungi & Their Allies, Second Edition. MacMillan Publishers Pvt. Ltd., Delhi, India
18. Webster, J. and Weber, R., (2007). Introduction to Fungi. Third Edition, Cambridge University Press, Cambridge and New York.