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MAA SHAKUMBHARI UNIVERSITY
SAHARANPUR, UTTAR PRADESH



Syllabus of:

Pre Ph.D. (Botany)

(As per guidelines of U.P. Government in accordance with

National Education Policy-2020) w.e.f. 2024-25

Members from the Board of Studies

S.No.	Name	Signature
1.	Prof. Garima Jain , Dean, Faculty of Science, MSU, Saharanpur	
2.	Prof. Sanjeev Kumar , Department of Botany, D.A.V. (P.G.) College, Muzaffarnagar (Convener)	<i>Sanj</i>
3.	Prof. Ritu Agarwal , Department of Botany, M.S. College, Saharanpur (Member)	<i>on-line</i>
4.	Dr. Yogendra Kumar , Department of Botany, Govt. Degree College Nanauta, Saharanpur (Member)	<i>on-line</i>
5.	Dr. Rakesh Kumar , Department of Botany, VSP Govt. (P.G.) College, Kairana, Shamli (Member)	
6.	Prof. Rup Narayan , Department of Botany, CCSU, Meerut (External Expert)	<i>on-line</i>
7.	Prof. Alok Srivastava , Department of Plant Science, MJPRU, Bareilly (External Expert)	<i>on-line</i>

Eligibility for Admission to Pre PhD (Botany): Students must have passed Master of Science in Botany/Plant Sciences/Bio Sciences/Life Sciences (excluding Zoology & Microbiology) from any recognized University equivalent with 55% aggregate.

Courses of Pre PhD (Botany): In Pre PhD there shall be five compulsory papers (16 credits=4+2+2+2+2+4) and one project work (4 credits). The papers will be as follows-

1. Four papers will be related to the concern subject. Each paper will be of 2 credits (2+2+2+2 credits =8 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. As proposed 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 Papers in Pre PhD (Botany)

Course Code	Paper Title	Credits	Int. Marks	Ext. Marks	Total Marks
1120401	Research Methodology & Computer Applications	04	25	75	100
1120402	Research Techniques in Plant Sciences	02	25	75	100
1120403	Biology & Diversity of Plants	02	25	75	100
1120404	Ecological studies in Plants	02	25	75	100
1120405	Advances in Plant Sciences	02	25	75	100
1120461	Research Project	04			100

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7. Oct. 2024

Paper1

Research Methodology & Computer Applications

Course code: 1120401

Total duration: 60 hours

Objectives:

This course is common for doctoral research students of all the subjects in Science faculty. The objective of the course is to acquaint research student with scientific research methods and approaches.

UNIT 1: Basic principles of research, objectives of research, importance, types of research: basic and applied, Selection of a research topic and problem, assessment of current status of topic chosen, literature survey and reference collection, formulation of hypothesis, research designs, sampling designs, ethics in research, code of ethics fabrication of data, Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP), Biosafety regulations in biological research and bioethics

12 hours

UNIT 2: Types and sources of data, data collection methods, primary data, secondary data, analysis for specific type of data, tabulation and graphical representation, central tendency, dispersion, skewness, correlation, regression, chi-square test, t- and F-tests, ANOVA- One way and two-way, Important non-parametric tests- Sign, Run, Kendall's coefficient.

12 hours

UNIT 3: Significance of report writing, different steps in writing report and research papers, layout of the research report, oral and written presentation of research (Abstract/Synopsis), mechanics of writing research reports, Precautions in writing research reports, conclusions, Impact factor and Citation index.

12 hours

UNIT 4: 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, auto layout with power point screen, 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

UNIT 5: 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 behaviour and vice versa, types 5. Violation of publication ethics, authorship and contributorship 6. Identification of publication misconduct, complaints and appeals 7. Predatory publishers and journals

Electronic journals, e-books, digital libraries, searching research information using Jgate and SCOPUS, Science Direct.

Research Metrics

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

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
Techniques in Plant Sciences
Course code: 1120402

Total duration: 30 hours

Unit I.

10 hours

Microscopy: Principles of Microscopy, Confocal microscopy, Fluorescence Microscopy, Electron Microscopy, Phase Contrast microscopy; Atomic Force Microscopy,
Microtomy: Microtomy/Microtome & its types and methods, staining of plant material,

Unit II

10 hours

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 III.

10 hours

Chromatographic Technique: Paper chromatography, Thin Layer Chromatography (TLC), High Performance Liquid Chromatography (HPLC), HPTLC, Gas -Liquid chromatography (GLC), Isoelectric Focusing.
Electrophoresis: PAGE, SDS PAGE, DIGE, Gel electrophoresis (AGE, 2D etc.), ChIP, EMSA, Co-Immunoprecipitation.
Centrifugation, genome analysis, plants tissue culture techniques and other recent advances in techniques



Paper 3

Biology & Diversity of Plants Course code: 1120403

Total duration: 30 hours

Unit 1.

8 hours

Taxonomic advancement in various groups of algae and their molecular phylogeny.
Features of model organisms from cyanobacteria (*Synechocystis* sp. PCC 6803, *Nostoc* sp. PCC 7120) 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.

Unit II.

8 hours

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; pattern triggered and effector triggered immunity, ISR and SAR.
Yeast as a eukaryotic model organism: mutant creation and characterization, yeast vectors, yeast two hybrid system, genetic and physical interactions studies in yeast, SGA analysis, functional genomics and proteomics studies in yeast.

Unit III.

8 hours

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.
Circumscription of genus & species, Description of new genus & species.

Unit IV.

6 hours

Recent advances in Gymnosperm, Pteridophytes, bryophytes, Angiosperms and their applications
Medicinal Plants, herbal products, drug formulation



Paper 4

Ecological studies in Plants Course code: 1120404

30 Hours

Unit I.

10 hours

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

Unit II

10 hours

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) bio-sociological. analytical techniques ordination and synthetic

Unit III

10 hours

Effect of Soil, Water, Air & Industrial pollutants on Plants, plant mechanism of interaction with pollutants
Effect of radiations (X-ray, UV, Alpha, beta and gama, smart phones on plants, methods to combat ionizing and non-ionizing radiation , Green energy, climate change

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Paper 5

Advances in Plant Sciences
Course code: 1120405

30 Hours

Unit I

10 hours

Plant Stress physiology, mechanism, biochemical profiling of metabolites, pathways, nano particle uptake, translocation, mechanism in plants, potential for crop improvement, transgenic molecular markers, cell signaling, different cascade, plant growth hormones, mechanism of plant growth and development. Industrial product from microbes, Bioaccumulations.

Unit II:

10 hours

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

Next generation Sequencing Technologies: 454 Pyrosequencing, Reversible Terminator Sequencing, 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.

Unit III

10 hours

Computational Biology: Sequences Alignment(Pair wise and multiple alignment), Phylogenetic analysis- Methods and Tools, gene prediction, ORF finding. **Homology:** Orthology & paralogy. **Databases:** NCBI, EMBL, DDBJ, Gene bank, Pubmed; Ensembl, Phytozome etc Online tools - BLAST, ORF finder, Primer3, protein motif and structure prediction tools. Generation and analysis of whole genome data, Whole genome annotation taking examples of major plant genomes.

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References:

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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.
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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. 2nd 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.
19. Kocchar, S.L and gujral, S.K 2012 plant physiology, Cambridge
20. Salis bury and ross (2005) plant physiology CBS India
21. Hopkins and norman 2014 introduction to plant physiology, wiley India
22. Goodwin & mercer 2005 plant bio chemistry
23. Sergey edited 2017, plant stress physiology, CABI
24. Taiz & zeiger (2018) plant physiology & development, oxford press