



VIVEK UNIVERSITY

[Estd. by Govt. of Uttar Pradesh, as per Uttar Pradesh Private Universities Act, 2019, no.21 of 2024.]
MORADABAD ROAD, POST AGRI, BIJNOR, UTTAR PRADESH-246701, INDIA

Syllabus

Pre-Ph.D. Course Work

Botany

Effective from Academic Session (2024-2025)

Course Structure and the Assessment Scheme of Pre Ph.D. Course Work Syllabus

SN	Paper Code	Subject	Credits L:T:P	Total credit	Total marks (External + Internal)	Minimum marks to be scored for successful completion
1		Research Methodology (Common for All)	3:1:0	4	60+40	50
2		Research & Publication Ethics (Common for All)	1:1:0	2	30+20	25
3		Quantitative Methods and Computer Applications (Common for All)	3:1:0	4	60+40	50
4		Recent Advances in Botany	3:1:0	4	60+40	50
5		Field work (Seminar/ workshop/ conferences/ literature review)	0:0:4	4	(0+100)	50
Total				18	450	225

Note: 1. A Ph.D. scholar must attain a minimum of 55% marks in aggregate.

2. Internal marks shall be based on assignments/class activity/case study and other academic activities provided by course instructor.

Programme objectives:

1. Equip themselves with ethical issues related to Research and Publication.
2. Offer expertise, resources, and services to the community in the field of Botany.
3. Proficiency with fundamental knowledge in several specialized areas of research and expertise in at least one area of research related to Botany.
4. To contribute the advancement of knowledge and technology to enhance activities in Botany
5. Organize and conduct research (advanced project) in a more appropriate manner.

Programme Outcomes:

1. Provide students with knowledge, general competence, and analytical skills in Research Methodology, Research& Publication Ethics, Botany, Forestry and plant diversity.
2. Build their foundation for research in Botany and their field.
3. Provide hands-on experience to carry out research work in Botany as well as interdisciplinary areas.
4. Knowledge and understanding of ethical standards in proposing, executing, and communicating scientific research.

5. Ability to communicate concepts and results to a technical audience in the form of conference papers, journal papers, and/or oral presentations etc.

Programme Specific Outcomes:

1. Apply appropriate research methodology, tools & techniques for systematic investigation, data analysis and solving the problems.
2. Gain ability to apply knowledge of Botany to research in real-world issues.
3. Get familiar with current research trends in various core areas of Botany.
4. Leadership and self-reliance Impact leadership abilities to the students to lead and excel in their respective fields. Also, the training will make students self-reliant.

Paper-I: Research Methodology (Common)

Course objectives:

1. To understand some basic concepts of research and its methodologies & identify appropriate research topics.
2. Select and define appropriate research problem and parameters.

Course outcomes:

Upon successful completion of the course, students will be able to:

1. To familiarize the research scholar with the fundamentals of scientific research.
2. To develop understanding of the basic framework of research process.
3. To develop an understanding of various research designs and techniques.
4. To identify various sources of information for existing research and data collection.
5. To develop an understanding of the ethical dimensions of conducting applied research.
6. Apply the theoretical and experimental knowledge into research work.

Unit-I

- **Scientific Research:** Meaning, importance and characteristics of scientific research, validity in research, Selection and formulation of Research Problem, Research Design, Phases/stages in research; types of research- qualitative, quantitative, exponential, exploratory, empirical, descriptive, ex-post facto, case studies, historical studies, philosophical studies, quasi-experimental; ethical problems in research; constructs and variables- nature of construct and variables, concept of constructs, type of variables, continuous and categorical, constructs, observables and intervening variables; Review of literature- purpose of the review, sources of the review, preparation of index card for reviewing and abstracting.

Unit-II

- **Methods of Research:** General Survey of various methods including Survey Method, Interdisciplinary Method, Case Study Method, Sampling Method, Observation Method, Interview Method, Schedule Method, Questionnaire Method, Documentary Method,

Library Method, Historical Method and Scientific Method. Characteristic Features of Scientific Method; Empirical Verifiable, Cumulative, Self - Correcting, Deterministic, Ethical & Ideological neutrality (Value Free).

Unit-III

- **Problem Identification and Hypothesis Formation:** Problem- meaning and characteristics of a problem, types of problem, generality and specific of problem; hypothesis- meaning and characteristics of a good hypothesis, types of hypotheses, formulating a hypothesis, ways of stating a hypothesis; testing experimental hypothesis- standard error, test of significance, level of significance, degrees of freedom, errors in hypothesis- type I, type II errors.

Unit-IV

- **Sampling and Research Design:** Meaning and types of sampling; probability and non-probability sampling. Methods of drawing samples, requisites of a good sampling method, sample size, sampling error; meaning and purpose of research design, types of research design, criteria of a good research design, basic principles of experimental design.

Unit-V

- **Report Writing:** Meaning and significance of report writing, types of report, steps in writing report, layout of the research report, precaution in writing research report, developing thesis report, formatting, inside citations, references and bibliography. Locating Information on a Topic of Interest, Acquiring Copies of Articles of Interest, The Nature of Scientific Variables, Conceptual Versus Operational Definitions of Variables, Levels of Measurement, Various Paradigms, The Basic Format for a Research Report, Identification of the Parts of a Research Report, Citation and Referencing Styles, Essentials of Report Writing, Aids for Writing Good Research Report

Suggested Reading:

- Bagchi, Kanak Kanti (2007) Research Methodology in Social Sciences: A Practical Guide, Delhi, Abijeet Publications.
- Kothari, C.R (2004) Research Methodology: An Introduction, Delhi, New Age.
- Flyvbjerg, Bent (2001) Making Social Science Matter: Why Social Inquiry Fails and How it can Succeed Again, United Kingdom, Cambridge University Press.
- Goodde and Hatte (1952) Methods in Social Research, New York, McGraw – Hill.
- Cooper & Schindler, Business Research Methods, Tata McGraw Hill.
- Broota, K.D., Experimental Designs in Behavioural Research, New Age International.
- Singh A. K., Test Measurement and Research Methods in Behaviours Sciences, Bharti Bhawan.

Paper-II: Research & Publication Ethics (Common)

Course objectives:

1. To understand the philosophy of science and ethics, research integrity and publication ethics research misconduct.
2. To understand indexing and citation databases, open access publications, research metrics (citations, h-index, impact Factor, etc.), predatory and clone Journals.

Course outcomes:

Upon successful completion of the course, students will be able to:

1. To develop an understanding of research ethics, publications misconduct and plagiarism.
2. To develop Intellectual honesty and research integrity as per committee of publication ethics.
3. To identify various sources of information for data bases and research matrices.
4. To develop an understanding of Open access publications and initiatives.
5. To understand the usage of similarity index tools.
6. Appreciate the components of scholarly writing and evaluate its quality

I. Philosophy and Ethics: Introduction to philosophy: definition, nature and scope, concept, branches. Ethics: definition moral philosophy, nature of moral judgements and reactions.

II. Scientific Conduct: Ethics with respect to science and research, Intellectual honesty and research integrity, Scientific misconducts: Falsification and Plagiarism (FFP), Redundant publication: duplicate and overlapping publication, salami slicing, Selective reporting and misrepresentation of data.

III. Publication Ethics: Publication ethics: definition, introduction and importance, Best practices / standards setting initiatives and guidelines: COPE, WAME, etc. Conflicts of interest, Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, violation of publication ethics, authorship and contributor ship,

Identification of publication misconduct, complaints and appeals, Predatory publishers and journals Practice.

IV. Open Access Publishing: Open access publications and initiatives, SHERPA / RoMEO online resource to check publisher copyright and self-archiving policies, Software tools to identify predatory publications developed by SPPU, Journal finder / journal suggestion tools viz. JANE, Elsevier journal Finder, Springer, Journal Suggester, etc.

V. Publication Misconduct: Group Discussion, Subject specific ethical issues, FFP, authorship, Conflicts of interest, Complaints and appeals: examples and fraud from India and abroad. Software tools, Use of plagiarism software like Turnitin, Drillbit, iThenticate and other open-source software tools.

VI. Databases and Research Metrics: Databases, Indexing databases, Citation databases: Web of Science, scopus, etc., Research Metrics, Impact factor of journal as per journal Citation report, SNP, SJR, IPP, Cite score, Metrics: h-index, g index, i10 index, altmetrics.

Paper-III: Quantitative Methods and Computer Applications (Common)

Course objectives:

1. To gain familiarity about various data collection tools and techniques, data analysis and interpretation along with the application of computer and statistical software in research.
2. Application of various statistical and computer software's in research and development.

Course outcomes:

Upon successful completion of the course, students will be able to:

1. Analyse qualitative and quantitative data, and explain how evidence gathered supports or refutes an initial hypothesis.
2. Describe descriptive and inferential statistics techniques.
3. To apply the statistical techniques and computer software's for data analysing.
4. Develop research skills of administering research tools and data collection.
5. Able to locate the research studies available in the Internet and use of online journals and books,
6. Use computer techniques and software's for research & data analysing.

Unit-I

- **Measurement and Scaling Techniques:** Measurement in research, measurement scales sources of errors in measurement, tests of second measurement, techniques of developing measurement tools, meaning of scaling, scale classification bases, important scaling techniques, and scale construction techniques.

Unit-II

- **Data Collection, Processing and Analysis:** Methods of data collection – primary data, secondary data; primary data collection – observation method, interview method, questionnaires, schedules, guideline for constructing questionnaires/schedules, secondary data collection of, selection of appropriate

method of data collection; coding, editing and tabulation of data, charts and diagrams used in data analysis, bar and pie diagrams and their significance; measures of central tendency, measures of dispersion; correlation and regression analysis - meaning and uses, methods of calculation of coefficients and their analysis and implication. sampling distribution, sampling schemes and sample sizes, confidence interval for the mean, t-statistic, z-statistic, confidence interval for the population variances, hypothesis testing, test of hypothesis for the population mean, population variance and ratio of two population variances; applications of z-test, t-test, f-test and chi-square test, association of attributes and techniques of testing, ANOVA.

Unit-III

- Fundamental knowledge of computer, statistical software and their application, application of statistical tests/techniques through the use of statistical software like SPSS, scientific packages like LISREL, AMOS, and SYSTAT for documentation and report generation.

Unit-IV

- **Introduction to MS-Office:** MS-WORD, MS-EXCEL, MATLAB, LATEX, MINITAB, R- programming. Applications of AI & ML in research.

Suggested Reading:

- Power Analysis for Experimental Research: A Practical Guide for the Biological, Medical and Social Sciences by R. Barker Baushell, Yu-Fang Li, Cambridge University Press.
- Chandan J. S., Statistics for Business and Economics, Vikas Publications.
- Broota, K.D., Experimental Designs in Behavioral Research, New Age International.
- Singh A. K., Test Measurement and Research Methods in Behavioral Sciences, Bharti Bhawan.
- Joyce Cox & Polly Urban, Microsoft Office, Galgotia Publishing.

- Sinha P.K., Computer Fundamentals, BPB Publishing.
- LaTeX: A Document Preparation System, 2/E Pearson Low Price Edition by Lamport.
- MATLAB: An Introduction with Applications by Gilat, Wiley India Pvt. Ltd.
- Getting Started with MATLAB by Rudra Pratap, Oxford University Press.

Paper-IV: Recent Advances in Botany

Course Objectives:

1. Provide an in-depth understanding of current advances in biodiversity, ecology, and plant sciences.
2. Develop practical skills in biotechnology, molecular biology, and biochemical methodologies.
3. Encourage integration of traditional knowledge with modern plant research for sustainable development.
4. Foster critical thinking in identifying plant-based solutions to environmental and agricultural issues.
5. Prepare students for advanced research, teaching, or industry roles in plant and life sciences.

Course Outcomes:

Upon successful completion of the course, students will be able to:

1. Understand the principles of biodiversity conservation, ecological tools, and environmental policies.
2. Apply biotechnological and enzymatic techniques in plant science and crop improvement.
3. Analyze plant disease resistance mechanisms and stress physiology using modern tools.
4. Explore the traditional knowledge systems and applications in ethno botany and ethno pharmacology.
5. Utilize advanced tools and techniques in plant identification, gene cloning, and biochemical analysis.

Unit-I

Biodiversity and Ecology: Introduction, estimation, distribution, significance, causes of depletion and conservation strategies; Biodiversity hot spots; Impact of climate change on biodiversity; Biodiversity and biotechnology relationship; Biopiracy and intellectual property rights; Organizations involved in biodiversity conservation; Indian biodiversity Act (2002).

Concept of ecosystem, methods used for ecosystem analysis- Qualitative and quantitative approaches, Methods of estimation of plant productivity, Tools to study global climate change, Tools to restore degraded ecosystems, Modern techniques and tools for ecological studies- GPS, GIS and remote sensing, National Forest policy 1988, National Biodiversity Policy 1998, National Biodiversity Act 2002, National policy on wetlands 2005, REDD+ , Kyoto protocol, Rio Earth summit

Unit-II

Plant Biotechnology and Enzymology: Totipotency, methods of application, Plant cell and tissue culture, methods of sterilization, establishment of aseptic culture, types and preparation of culture media, Transgenic plants: their applications and ethical concerns, Advantages of molecular markers in transgenic crops. Role of engineering in stress tolerance, Kinds of molecular markers-Proteins markers, Isozyme markers and DNA markers, advantages, disadvantages & applications of molecular markers in the field of molecular biology, Relationship among different molecular markers.

Enzyme Technology: Introduction to enzymes, specificity of enzyme action, kinetic and chemical mechanisms of enzyme – catalyzed reactions, enzyme inhibition, active site structure, enzyme assay, application of enzymatic analysis in agriculture, environment, medicine and forensic science and industry. Stability, denaturation and renaturation of enzymes, immobilized enzymes and their uses, Biosensors. Recent advances in enzyme technology, future prospects for enzyme technology.

Unit-III

Plant Disease Management and Stress Physiology: Identification and classification of fungi, recent concept of plant defence: Mechanism of sensing pathogenecity, Systemic Acquired Resistance, Biochemical defence, Biological control of plant diseases, chemicals in plant disease management. Uses of modern biotechnological tools in crop management. Testing for host resistance to diseases.

Physiological Effects and Mechanism of action of Auxins, Gibberellins, Cytokinins, Absciscic acid, Polyamines and Salicylic acid Water deficit and its physiological consequences, drought tolerance mechanisms, salinity stress and plant responses, heat stress and heat shock proteins, metal toxicity, pollution stress. biotic stress , HR and SAR mechanisms. biotechnological approaches for stress tolerance in plants.

Unit-IV

Ethnobotany and Ethnopharmacology: Concept of ethnobotany; Objectives and Scope: Linkages with other disciplines The Ethnic Groups: Hill region, Arid and Semi-arid region, Tools and techniques used in Ethnobotanical Studies; Endogenous Regulations: Role of temple, sacred place, sacred groves and community protocols, IUCN and Ethnobotanical

Species: The IUCN principles, Status of ethnobotanically important species, Medico-ethnobotany: Systems of indigenous medicines and their availability.

Definition of ethnopharmacognosy, scope and applications of herbal medicines, Importance of ethnopharmacological studies. Plant chemicals in modern pharmacology: Bioavailability and pharmacokinetics aspects of herbal drugs with examples. Phytoequivalence, pharmaceutical equivalence. WHO guidelines for assessment of herbal drugs; authentication and standardization of herbal raw materials.

Unit – V

Tools and Techniques: Principle & application of gel filtration, ion exchange chromatography, thin layer chromatography, gas chromatography; High pressure liquid chromatography (HPLC), Electrophoresis (agarose and page); Isoelectric-focussing (IEF); Ultracentrifugation (Velocity and buoyant density). Gene cloning: Isolation and Purification of DNA from living cells total cell, Plasmid DNAs, PCR, RT-PCR, pulse field electrophoresis for separation of large DNA molecules, Introduction of DNA in to the host cells and selection, Principles & technique of nucleic acid hybridization & cot curve, sequencing of nucleic acid, Southern, Northern, & Western blotting techniques

Plant identification: International code of Botanical Nomenclature: Salient features, important rules and recommendation; Identification keys; Herbarium Methodology: Collection, poisoning, drying and preservation of herbarium specimens, Important National and International herbaria; Ethnobotanical survey techniques.

Suggested Reading:

- Wilson, E.O. (1992). **Biodiversity**. National Academy Press, Washington, D.C.
- Jeffries, M.J. (2006). **Biodiversity and Conservation**. Routledge, London.
- Jain, S.K. (1991). **Glimpses of Indian Ethnobotany**. Oxford & IBH Publishing Co., New Delhi.
- Odum, E.P. & Barrett, G.W. (2005). **Fundamentals of Ecology** (5th Ed.). Thomson Brooks/Cole.
- Begon, M., Townsend, C.R., & Harper, J.L. (2006). **Ecology: From Individuals to Ecosystems** (4th Ed.). Wiley-Blackwell.
- Chawla, H.S. (2009). **Introduction to Plant Biotechnology** (3rd Ed.). Science Publishers, Enfield.
- Stewart, C.N. Jr. (2008). **Plant Biotechnology and Genetics: Principles, Techniques, and Applications**. John Wiley & Sons.
- Palmer, T. & Bonner, P. (2007). **Enzymes: Biochemistry, Biotechnology, Clinical Chemistry** (2nd Ed.). Woodhead Publishing.
- Price, N.C. & Stevens, L. (2011). **Fundamentals of Enzymology: The Cell and Molecular Biology of Catalytic Proteins** (3rd Ed.). Oxford University Press.
- Agrios, G.N. (2005). **Plant Pathology** (5th Ed.). Elsevier Academic Press.
- Singh, R.S. (2011). **Plant Disease Management**. Oxford & IBH Publishing Co., New Delhi.

- Shabala, S. (2012). **Plant Stress Physiology**. CABI Publishing.
- Pareek, A., Sopory, S.K., Bohnert, H.J., & Govindjee (Eds.). (2010). **Abiotic Stress Adaptation in Plants: Physiological, Molecular and Genomic Foundation**. Springer.
- Cotton, C.M. (1996). **Ethnobotany: Principles and Applications**. John Wiley & Sons.
- Kirtikar, K.R. & Basu, B.D. (2001). **Indian Medicinal Plants** (Vol. I–IV). Bishen Singh Mahendra Pal Singh, Dehradun.
- Rangari, V.D. (2008). **Pharmacognosy and Phytochemistry** (Vol. I & II). Career Publications, Nashik.
- Wilson, K. & Walker, J. (Eds.). (2010). **Principles and Techniques of Biochemistry and Molecular Biology** (7th Ed.). Cambridge University Press.
- Sharma, D. (2012). **Tools and Techniques in Biology**. Campus Books International, New Delhi.