

**DEPARTMENT OF BOTANY
UNIVERSITY OF LUCKNOW**

PH.D. PROGRAMMES

1. PH.D. BOTANY

PROGRAMME OUTCOMES (POs):

Subsequent to obtaining a PhD degree, the student would be proficient in:

- PO 1:** Identification of research gaps, creation of new knowledge and awareness, and zealous exploring of future challenges
- PO 2:** Project management skills, such as organizing and undertaking research projects, experiments, etc., including budgeting, contingency planning, and time management
- PO 3:** Identification of problems and development of suitable methodologies for its solutions
- PO 4:** Skills and practices necessary for time management, good laboratory practices and safety norms
- PO 5:** Ability to work both independently and as part of a team

PROGRAMME SPECIFIC OUTCOMES (PSOs):

- PSO 1:** Designing and formulating experiments for the research problems pertaining to structure and function of plants, and associated organisms.
- PSO 2:** Ability to analyze relevant literature and apply to the development of innovative plant based research
- PSO 3:** Ability to solve problems and present research findings with good written and oral communication skills
- PSO 4:** Handling of data, such as recording and collating data, using appropriate techniques and equipments, and statistically analyzing it
- PSO 5:** Good understanding of information technology
- PSO 6:** Competence for a career in academia or applied fields in Botany, Environmental Science, and allied subjects

COURSE STRUCTURE:

Paper	Paper Title	Credits	MM
I	Research Methodology	4	30+70=100
II	Trends in Plant Science	4	30+70=100
Project work	Submission and presentation of Review article in the specialized field		

PH.D. BOTANY PAPER I: RESEARCH METHODOLOGY

COURSE OBJECTIVE:

To understand the basic methods and tools for research

COURSE OUTCOMES (COs):

- CO 1:** Gain an understanding of varied researches, research designs, formulation of research and criteria for good research
- CO 2:** Acquire ability to review literature and documenting, and presenting data in a format suitable for publication in peer-reviewed journals
- CO 3:** Knowledge of intellectual property rights (IPR) including patents, copy rights, design registration and their filing, publishing and granting agencies
- CO 4:** Understanding the ethical considerations in research, plagiarism, quality of Journals, citations, indexing
- CO 5:** Analysis of data, data collection and presentations, use of statistical tools for interpretation of data, and testing of hypothesis.

PH.D. BOTANY PAPER II: TRENDS IN PLANT SCIENCE

COURSE OBJECTIVE:

To offer opportunities for research and teaching in a range of specialized areas within Botany

COURSE OUTCOMES (COs):

- CO1:** Acquire theoretical and practical knowledge of methods involved in the separation and analysis of bio-molecules and structures, such as microscopy, spectrophotometry, electrophoresis, chromatography, centrifugation, PCR and base sequencing

- CO 2:** Applicability of Bioinformatics in genome sequencing and annotation
- CO 3:** Knowledge of species, genetic and molecular diversity for conservation of endangered species
- CO 4:** Understanding plant-microbe interactions and remediation of degraded soils by plant microbes
- CO 5:** Nutrient use efficiency and approaches for tolerance to biotic and abiotic stress
- CO 6:** Use of molecular markers (protein, isozyme and DNA) for genetic engineering
- CO 7:** Acquire the knowledge about recent developments in the area of interest chosen for a PhD programme

2. PH.D. ENVIRONMENTAL SCIENCE

PROGRAMME OUTCOMES (POs):

Subsequent to obtaining a PhD degree, the student would be proficient in:

- PO 1:** Identification of research gaps, creation of new knowledge and awareness, and zealous exploring of future challenges in this field
- PO 2:** Project management skills, such as organizing and undertaking research projects, experiments, etc., including budgeting, contingency planning, and time management
- PO 3:** Identification of problems and development of suitable methodologies for its solutions
- PO 4:** Skills and practices necessary for time management, good laboratory practices and safety norms
- PO 5:** Ability to work both independently and as part of a team

PROGRAMME SPECIFIC OUTCOMES (PSOs):

- PSO 1:** Designing and formulating experiments for the research problems pertaining to structure and function of plants, and associated organisms.
- PSO 2:** Ability to analyze relevant literature and apply to the development of innovative plant based research
- PSO 3:** Ability to solve problems and present research findings with good written and oral communication skills
- PSO 4:** Handling of data, such as recording and collating data, using appropriate techniques and equipments, and statistically analyzing it
- PSO 5:** Good understanding of information technology
- PSO 6:** Competence for a career in academia or applied fields in Botany, Environmental Science, and allied subjects

COURSE STRUCTURE:

Paper	Paper Title	Credits	MM
I	Research Methodology	4	30+70=100
II	Advances in Environmental Science	4	30+70=100
Project work	Submission and presentation of Review article in the specialized field		

PH.D. ENVIRONMENTAL SCIENCE PAPER I: RESEARCH METHODOLOGY

COURSE OBJECTIVE:

To understand the basic methods and tools for research

COURSE OUTCOMES (COs):

- CO 1:** Gain an understanding of varied researches, research designs, formulation of research and criteria for good research
- CO 2:** Acquire ability to review literature and documenting, and presenting data in a format suitable for publication in peer-reviewed journals
- CO 3:** Knowledge of intellectual property rights (IPR) including patents, copy rights, design registration and their filing, publishing and granting agencies
- CO 4:** Understanding the ethical considerations in research, plagiarism, quality of Journals, citations, indexing
- CO 5:** Analysis of data, data collection and presentations, use of statistical tools for interpretation of data, and testing of hypothesis.

PH.D. ENVIRONMENTAL SCIENCE PAPER II: ADVANCES IN ENVIRONMENTAL SCIENCE

COURSE OBJECTIVE:

To offer opportunities for research and teaching in a range of specialized areas within Environmental Sciences

COURSE OUTCOMES (COs):

- CO1:** Acquire theoretical and practical knowledge of methods involved in the separation and analysis of bio-molecules and structures, such as microscopy, spectrophotometry, electrophoresis, chromatography, centrifugation, PCR and base sequencing

- CO 2:** Applicability of Bioinformatics in genome sequencing and annotation
- CO 4:** Formulate techniques to handle hazardous chemicals in the environment and their biotransformation into harmless substances
- CO 5:** Formulate environmental policies and national movements
- CO 6:** Applications of remote sensing in managing environmental problems
- CO 7:** Acquire the knowledge about recent developments in the area of interest chosen for a PhD programme