

DEPARTMENT OF BOTANY

Maharshi Dayanand University, Rohtak

**Syllabus and Scheme Examination
Ph.D. (Botany)**



Maharshi Dayanand University

Rohtak (Haryana)-124001

DEPARTMENT OF BOTANY**PROGRAM ARCHITECTURE, DURATION, SCHEME OF EXAMINATION, WORKLOAD/WEEK AND CREDITS FOR Ph.D. PROGRAM IN BOTANY w.e.f. 2025-26****Program Specific Objectives (PSOs)**

Students who obtain degree in Ph.D. (Botany) will be able to:

PSO1 Articulate and apply basic principles related to techniques and equipment used in botanical investigation.

PSO2 Critically analyze data and use results to evaluate hypotheses in the context of primary literature.

PSO3 Formulate hypotheses informed by primary literature and test them using appropriate experimental and observational approaches.

PSO4 Prepare and give a written or oral presentation, using data that synthesizes information from multiple sources including primary scientific literature.

Duration: **One Semester (Six months)**

Total Credit requirement: **12 credits**

Program Structure: **Ph.D. course work in Botany**

Course Code	Nomenclature of Course	Maximum marks	Hours/Week	Credits
25BOTPH11C1	Research methodology	100	4	4
23CCPH11C1	Research and Publication Ethics	50	2	2
25BOTPH11C2	Techniques in Plant Sciences	50	2	2
25BOTPH11C3	Advances in Plant Sciences	100	4	4
Total Marks/Credits		300		12

Note: The compulsory course on 'Research and Publication Ethics' shall be offered by **Ch. Ranbir Singh Institute of Social and Economic Change** for all UTDs/Centres/Institutes

Formative assessment in Ph.D. Course work will be applicable as under (from 2025 – 2026 session)

For Four credits theory

	Marks distribution
Written test (2 X 15)	30
MCQs/ Quizzes/ Group Discussion (2 X 10)	20
Case study / Mini project (1X25)	25
Seminar / Presentation (2 X 10)	20
Attendance	05
Total	100

For Two credits theory

	Marks distribution
Written test (2 X 5)	10
Peer Discussion/Debate/Extempore speech (2 X 10)	20
Role play	05
Essay/Article/Report writing	10
Attendance	05
Total	50

Note: A Ph.D. scholar must obtained a minimum of 55% marks or its equivalent grade in UGC 10

point scale in the course work to be eligible to continue in the program & submit his or her thesis

Paper-1 Research Methodology

Name of the Program	Ph.D. Course work in Botany	Program Code	BOTPH
Name of the Course	Research Methodology	Course Code	25BOTPH11C1
Hours/Week	4	Credits	4
Max. Marks	100		

Note: As per clause-8 (iv) of Ph.D. Ordinance w.e.f. 2025-26 Formative assessment will be applicable as:

	Marks distribution
Written test (2 X 15)	30
MCQs/ Quizzes/ Group Discussion (2 X 10)	20
Case study / Mini project (1X25)	25
Seminar / Presentation (2 X 10)	20
Attendance	05
Total	100

Course Objectives:

1. To train the students in formulation of the hypothesis and research objectives.
2. To prepare researchers to design experiment and apply sound methods and tools to conduct their research.
3. To develop a comprehensive knowledge of previous and current research in their field of expertise and be able to demonstrate clearly such knowledge
4. To train researchers to communicate their research clearly and professionally in both written and oral forms
5. To apprise about statistical techniques required in research.

Course Learning Outcomes:

1. Students will be able to identify the research problem and to design their experiments.
2. Students will be able to formulate and test their research hypothesis.
3. Students will be able to use various statistical tools and analyze their data.
4. Students will be able to write their research articles and reports.
5. Students will be able to present their research work at various platforms.

Unit-1

Research Methodology: Meaning of Research in Biological Sciences, Characteristics of Research, Research student and research supervisor, Process of research, Identification and criteria of selecting a research problem (Hypothesis), Formulation of objectives; Research plan and its components, Methods of Research and Difficulties in Biological research.

Unit-II

Research Proposal and experimental design: Key elements- Objective, Introduction, Design or Rationale of work, Guidelines for design of experiments, Material and methods, Designing biological experiments, Compilation and documentation of data; Major research institutes related to plant sciences in India, brief idea about government research agencies such as DBT, DST, ICMR, CSIR and UGC.

Unit-III

Writing and Presentation: Format of research paper and report writing, Procedure of Reference Citation, Significance of writing research papers and review articles, Major scientific publishers,

Impact factor and citation index, Designing of e-posters, Effective oral scientific communication to specialized audiences, including peer groups, as well as general audiences such as students, the general population and policy makers.			
Unit-IV			
Statistical applications: Standard deviation, Standard error, Co-efficient of variation, probability distributions: Binomial, Poisson and Normal Distributions (areas method only) include problems; Sample statistics and parameters, population null hypothesis, level of significance; Definitions and applications of Chi-square test, 't' and 'f' test; Analysis of variance with linear models, Analysis of Variance for one-way and two way classified data.			
References:			
<ol style="list-style-type: none"> 1. G.R. Basotia and K.K. Sharma (2002) Research Methodology, Mangal Deep Publications, Jaipur (India) 2. C.H. Chaudhary (2009) Research Methodology, RBSA Publication, New Delhi 3. Wayne Goddard & Stuart Melville (2004) Research Methodology: An Introduction, Juta and Company Ltd 4. Ranjit Kumar (2011) Research Methodology, SAGE Publication, New Delhi 5. Kothari, C.R. and Gaurav Garg (2019) Research Methodology: Methods & Techniques, New Age Publication, New Delhi 			
Paper 2 Research and Publication Ethics			
Name of the Program	Ph.D. Course work in Botany	Program Code	BOTPH
Name of the Course	Research and Publication Ethics	Course Code	23CCPH11C1
Hours/Week	2	Credits	2
Max. Marks.	50		
Note: As per clause-8 (iv) of Ph.D. ordinance w.e.f. 2025-26 Formative assessment will be applicable as:			
		Marks distribution	
Written test (2 X 5)		10	
Peer Discussion/Debate/Extempore speech (2 X 10)		20	
Role play		05	
Essay/Article/Report writing		10	
Attendance		05	
Total		50	
Course Objectives:			
Course Learning Outcomes:			
Unit – I			
Unit – II			
Unit – III			
Unit-IV			

Paper 3 Techniques in Plant Sciences			
Name of the Program	Ph.D. Course work in Botany	Program Code	BOTPH
Name of the Course	Techniques in Plant Sciences	Course Code	25BOTPH11C2
Hours/Week	2	Credits	2
Max. Marks.	50		
Note: As per clause-8 (iv) of Ph.D. ordinance w.e.f. 2025-26 Formative assessment will be applicable as:			
			Marks distribution
Written test (2 X 5)			10
Peer Discussion/Debate/Extempore speech (2 X 10)			20
Role play			05
Essay/Article/Report writing			10
Attendance			05
Total			50
Course Objectives:			
<ol style="list-style-type: none"> 1. To promote the understanding of various tools & techniques employed in botanical research 2. To expose the students to various biochemical techniques viz. spectroscopy, Crystallography Chromatography and Electrophoresis 3. To expose the students to various molecular techniques viz. PCR, cloning, protein sequencing 4. To train the student to conduct floristic and ethnobotanical research work 5. To familiarize the students about the use of scientific literature databases 			
Course Learning Outcomes:			
<ol style="list-style-type: none"> 1. Students will be able to use GC, HPLC, PCR, FTIR and other instruments for their scientific work. 2. Students will know practical knowledge of various laboratory and field botanical methods. 3. Students will be able to collect the plant specimens and identify them with the help of floras and manuals. 4. Students will be able to acquire technical competency and will be able to get employment in different sectors of research and development. 5. Students will be able to use computer programs for preparing & presenting their work 			
Unit – I			
Biochemical Techniques: NMR and ESR spectroscopy, Crystallography, Structure determination using X-ray diffraction and NMR, Different types of mass spectrometry and surface plasma resonance methods, Gel and affinity chromatography, gas chromatography; High pressure liquid chromatography (HPLC), Fast Protein Liquid Chromatography,			
Unit – II			
Molecular Techniques: Isolation and Purification of DNA, Variations in Polymerase Chain Reaction, study of products (DNA and proteins) after electrophoresis, Pulse field electrophoresis for separation of large DNA molecules, Principles & Technique of nucleic acid hybridization (Southern, Northern, & Western blotting techniques) Protein sequencing, RNA interference, CRISPR.			
Unit – III			
Techniques in Field Botany: Basic principles and methods of plant collection and identification; Importance of Herbarium, Assessment of endangered and threatened plant species, Sampling designs and analytical methods for determining ecological status of plant species; Ethnobotanical survey			

techniques: Designing questionnaire.

Unit – IV

Computer applications: Document preparation, MS Office Scientific editing tools, Popular image formats. Scientific literature databases: Science direct, google scholar and Pubmed. Primary databases: Gene bank, EMBL, DDBJ, Swiss Prot, PIR and MIPS. Sequence comparison via BLAST, FASTA and CLUSTAL-W; Motif analysis and presentation with PROSITE and PRINTS.

References:

1. Molecular cloning A Laboratory Manual 3rd edition Vol. 1, 2, 3- Sambrook and Russell, Churchill press, 2007
2. Principles and Techniques of Biochemistry and Molecular Biology, Edited by Keith Wilson and John Walker, Sixth Edition, Cambridge University Press.
3. Brown. T. A. (1995). Gene Cloning an Introduction. (3rd edition).Chapman Hall, 2-6 Bunday Row, U.K.
4. Albuquerque, U.P., Ramos, M.A., Ferreira Júnior, W.S., de Medeiros, P.M. (2017) Ethnobotany for Beginners. Springer International Publishing.
5. S K Jain and Vartika Jain (2017) Methods and Approaches in Ethnobotany: Concepts, Practices and Prospects. Deep Publication, New Delhi
6. Jain, Sudhanshu Kumar (2010). Manual of Ethnobotany. Scientific Publishers, Jodhpur, India.

Paper 4 Advances in Plant Sciences

Name of the Program	Ph.D. Course work in Botany	Program Code	BOTPH
Name of the Course	Advances in Plant Sciences	Course Code	25BOTPH11C1
Hours/Week	4	Credits	4
Max. Marks.	100		

Note: As per clause-8 (iv) of Ph.D. ordinance w.e.f. 2025-26 Formative assessment will be applicable as:

	Marks distribution
Written test (2 X 15)	30
MCQs/ Quizzes/ Group Discussion (2 X 10)	20
Case study / Mini project (1X25)	25
Seminar / Presentation (2 X 10)	20
Attendance	05
Total	100

Course Objectives:

1. To ensure that you can achieve an up-to-date level of understanding of plant science
2. To provide sound knowledge with understanding of status and significance of biodiversity
3. To familiarize the students about various concepts and techniques of molecular biology
4. To understand the mechanism of stress tolerance in plants and various approaches for stress protection.
5. To provide an overview of plant nanotechnology viz. synthesis, characterization and application of nanoparticles

Course Outcomes:

1. Students will get in-depth knowledge about the current status of biodiversity, IPR and

biopiracy.

2. Students will be able to understanding of genetic engineering, transgenic crops and molecular markers.
3. Students will be able to identify biotic and abiotic stress in plants and assess their physiological effects.
4. Students will be able to use of different protein and molecular markers in stress tolerance mechanism.

Unit – I

Biodiversity Conservation: Introduction to the dynamics of biodiversity; latitudinal and altitudinal gradients of biodiversity; Importance of biological resources for ecological integrity and human welfare; Major threats and conservation strategies for biodiversity conservation; National and international organizations and programmes associated with biodiversity; Indian Biodiversity Act (2002); Biodiversity Management Committees, People's Biodiversity Register; National Biodiversity Strategy and Action Plan; National Mission on Biodiversity and Human Well-Being

Unit – II

Molecular Biology: Kinds of Molecular markers- Proteins markers, Isozyme markers and DNA markers, advantages, disadvantages & applications of molecular markers in biotechnology, Relationship among different molecular markers. Cry genes- classification and properties, *Bacillus thuringensis* endotoxin and their mode of action. Advantages of molecular markers in transgenic crops, Biotechnological approaches for stress tolerance in plants.

Unit – III

Stress Physiology: Plant responses to abiotic and biotic stress at physiological, biochemical and molecular level: drought and flooding, salinity stress, elevated temperature and freezing stress, hypoxia and anoxia, nutrient excess and deficiency, heavy metals and metalloids, herbivory, insectivory, viral, bacterial and fungal interactions. Stress tolerance mechanism and approaches for stress protection. Physiological Effects and Mechanism of action of brassinosteroids, jasmonates, melatonin, strigolactones and polyamines.

Unit – IV

Nanobiotechnology: Physical and chemical nature of nanoparticles, methods of nanoparticle synthesis and characterization, Nanosupports for enzyme immobilization, methods of immobilization and properties of immobilized enzymes. Applications of immobilized enzyme in agriculture, environment and industry. Nanobiosensors: current status and future prospects. An overview of plant nanotechnology: opportunities as plant growth stimulators, controlled release delivery vehicles and antimicrobial agents. Nanotoxicological implications.

References:

1. Enzyme Technology by Martin Chaplin and Christopher Bucke (1990) Cambridge University Press.
2. Biocatalysts and Enzyme Technology by Klaus Buchholz , Volker Kasche, Uwe Theo Bornscheuer (2005), 1 edition, Wiley-VCH.
4. Enzyme Technology, edited by Ashok Pandey, Colin Webb and Carlos icardo Soccol (2006), Springer US.
5. Introduction to plant physiology by W.G. Hopkins and NPA Huner, Wiley Int.3rd Ed.
6. Old and Primrose (1984).Principles of gene manipulation. Blackwell
7. Patterson, 1996. Genome mapping in plants, Academic Press.330p
8. Weising, K., H. Nybom, K. Wolff, W. Meyere.1995. DNA Fingerprinting.CRL Press

