GURU KASHI UNIVERSITY

Doctor of Philosophy

In

Genetics and Plant Breeding

Session: 2025-26

Faculty of Agriculture

Program Structure									
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Total Credits**	**Int.**	**Ext.**	**Total Marks**
PPH101	Research Methodology	Core	4	0	0	4	30	70	100
PPH102	Research and Publication Ethics	Core	2	0	0	2	30	70	100
PPH104	Computer Applications in Research	Skill Based	0	0	4	2	30	70	100
PPH114	Advances in Plant Breeding system, Genomics in plant breeding, Molecular Cytogenetics for crop improvement, IPR and regulatory mechanisms.	core	4	0	0	4	30	70	100
Total Numbers of Credits						**12**	**120**	**280**	**400**

Course Title: Research Methodology

Course Code: PPH101

L	T	P	Credits
4	0	0	4

Total Hours: 60

Learning Outcomes

On the completion of the course the students will be able to

1. Formulate research problems by conducting comprehensive literature reviews utilizing web sources
2. Apply appropriate research design choices based on research questions and objectives.
3. Explore the integration of qualitative and quantitative data and the concept of triangulation and complementarily of data sources.
4. Utilize statistical software packages commonly used in research for importing, managing, cleaning, and analyzing data.
5. Apply different statistical techniques to summarize and analyze data effectively.

Course Content

Unit-I **15 Hours**

Introduction to Research

Meaning, Objectives, Characteristics, Significance and Types of Research. Understanding a Research Problem, Literature Review, Methods and Reporting, Selecting the Research Problem, Steps in Formulation of a Research Problem.

Unit-II **15 Hours**

Research Process and Hypothesis

Constructing Hypotheses; Conceptualizing a Research Design-Meaning and Types of Research Design. Parametric and Non-Parametric Test, Errors and Level of Significance. Completely randomized design, Random block design, Latin square design, Statistical analysis. Components of time series, Analysis of time series, Measurement of trend, Measurement of seasonal variations.

Unit-III **15 Hours**

Sampling Design and Data Analysis

Sampling Techniques-Probability and Non-Probability, Qualities of a good Sample, Sample Size and its Determination.

Introduction to Qualitative, Quantitative and Mixed Methods, Quantitative Methods- Univariate, Bivariate and Multivariate, Qualitative Methods- Grounded Theory and Triangulations, Mixed Methods- Convergent Parallel, Explanatory Sequential, Exploratory Sequential and Transformative.

Implementation of statistical techniques using statistical packages viz. SPSS R including evaluation of statistical parameters and data interpretation, Regression Analysis, Covariance, analysis of variance.

Unit-IV **15 Hours**

Report Writing

Types of Reports- technical and Popular Reports, Significance of Report Writing, Different Steps in Writing Report, Art of Writing Research Proposals, Research Papers, Projects Reports and Thesis; Basics of Citation and Bibliography/Reference Preparation Styles; Report Presentation: Oral and Poster Presentations of Research Reports.

Suggested Reading

1. *Gupta, S. (2010). Research Methodology and Statistical Techniques. Deep & Deep Publications (P) Limited, New Delhi.*
2. *Kothari, C.R., Garg, G. (2019). Research Methodology: Methods and Techniques. 4th Edition, New Age International (p) Limited. New Delhi.*
3. *Sahay, Vinaya and Pradumna Singh (2009). Encyclopedia of Research Methodology in Life Sciences. Anmol Publications. New Delhi.*
4. *Kauda J. (2012). Research Methodology: A Project Guide for University Students. Samfunds literature Publications.*
5. *Dharmapalan B. (2012). Scientific Research Methodology. Narosa Publishing*

Course Title: Research and Publication Ethics

Course Code: PPH102

L	T	P	Credits
2	0	0	2

Total Hours 30

Learning Outcomes

On the completion of the course the students will be able to

1. To have awareness about the publication ethics and publication misconducts.
2. To understand indexing and citation databases, open access publications, research metrics (citations, h-index, impact factor etc)
3. Develop hands-on skills to identify research misconduct and predatory publications.

Course Content

- **RPE 01: PHILOSOPHY AND ETHICS (3 Hrs.)**

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

- **RPE 02: SCIENTIFICCONDUCT (5 Hrs.)**

1. Ethics with respect to science and research
2. Intellectual honesty and research integrity
3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP)
4. Redundant publications: duplicate and overlapping publications, salami slicing
5. Selective reporting and misrepresentation of data

- **RPE 03: PUBLICATION ETHICS (7 Hrs.)**

1. Publication ethics: 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 behavior 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

PRACTICE

- **RPE 04: OPEN ACCESS PUBLISHING (4 Hrs.)**

1. Open access publications and initiatives
2. SHERPA/ROMEO online resource to check publisher copyright & self-archiving policies
3. Software tool to identify predatory publications developed by SPPU

- Journal finder / journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

- RPE 05: PUBLICATION MISCONDUCT (4 Hrs.)

A. Group Discussions (2 hrs.)

1. Subject specific ethical issues, FFP, authorship
2. Conflicts of interest
3. Complaints and appeals: examples and fraud from India and abroad

B. Software tools (2 hrs.)

Use of plagiarism software like Turnitin, Urkund and other open source software tools

- **RPE 06: DATABASES AND RESEARCH METRICS (7 Hrs.)**

A. Databases (4 hrs.)

1. Indexing databases
2. Citation databases: Web of Science, Scopus etc.

B. Research Metrics (3 hrs.)

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

Suggested Readings

1. *Bird, A. (2006). Philosophy of Science. Routledge.*
2. *MacIntyre, A. (1967) A Short History of Ethics. London.*
3. *P. Chaddah, (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarized, ISBN:978-9387480865*
4. *National Academy of Sciences, National Academy of Engineering and Institute of Medicine. (2009). On Being a Scientist: A Guide to Responsible Conduct in Research: Third Edition. National Academies Press.*
5. *Rensik, D. B. (2011). What is ethics in research & why is it important. National Institute of Environmental Health Sciences, 1-10. Retrieved from https://www.niehs.nih.gov/resources/biothics/whatis/index.cfm*
6. *Beall, J. (2012). Predatory publishers are corrupting open access. Nature, 489(7415), 179-179. https://doi.org/10.1038/489179a*

Course Title: Computer Applications in Research

Course Code: PPH104

L	T	P	Credits
0	0	4	2

Total Hours 30

Learning Outcomes

On the completion of the course the students will be able to

1. The students will become familiar with the usage of software for managing the reference.
2. To make literature reviews easily.
3. To make reference management by using open software.

Unit 1 **06Hours**

MS Word Essentials-Create a document with styled headings and subheadings, Add headers, footers, and page numbers, Adjust page layout settings (margins, orientation, page size).

Table Creation and Management-Insert, format, and style tables, Adjust cell size, merge/split cells, and sort/filter data.

Working with Graphics-Insert and format images, shapes, SmartArt, and text boxes, Apply text wrapping around objects.

Unit 2 **08Hours**

Basics of PowerPoint- Slide layouts, themes, and templates, Adding multimedia: Images, audio, and videos.

Advanced Techniques- Animations and transitions for visual effects, Slide master for consistent formatting, Interactive elements: Hyperlinks and action buttons.

Design Best Practices- Typography, color schemes, and visual hierarchy, Tips for engaging presentations.

Unit 3 **08Hours**

Introduction to Mendeley- Installing and setting up Mendeley Desktop and Web, Importing references from various sources.

Organizing References- Creating folders and tagging references, Annotating and highlighting PDFs.

Citations and Bibliography- Integrating Mendeley with MS Word, using citation styles (APA, MLA, Chicago), Generating a bibliography automatically.

Unit 4 **08Hours**

AI Tools for Productivity- Text-Based AI Tools (e.g., ChatGPT) Writing assistance, summarization, and brainstorming, Grammar and style checking, Image and Design Tools, Speech and Audio Tools

Suggested Readings

1) *Office 2007 in Simple Steps, Kogent Solutions, (Wiley Publishers).*
2) *MS-Office 2007 Training Guide, S. Jain (BPB Publications).*
3) *Computer Fundamentals by P.K. Sinha (BPB Publications).*
4) *https://www.mendeley.com/reference-management/reference-manager*
5) *https://chat.openai.com*
6) *https://edu.google.com/workspace-for-education/classroom/*

Course Title: Advances in Plant Breeding Systems, Genomics in Plant Breeding, Molecular Cytogenetics for Crop Improvement, IPR and Regulatory Mechanisms.

Course Code PPH114

L	T	P	Credits
4	0	0	4

Total Hours 60

Learning Outcomes

On the completion of the course the students will be able to

1. Determine breeding methods appropriate for different plant species and traits
2. Identify the regulations surrounding plant breeding, seed production, and variety development
3. Understand priorities of a private breeding program
4. Understand the theory and application of molecular markers in plant breeding
5. Critically analyze scientific articles related to plant breeding methods and approaches

Unit I **17 Hours**

Advances in reproductive biology of crops; Genes governing the whorls formation and various models proposed; Pollen pistil interaction: biochemical and molecular basis, environmental factors governing anthesis and bottlenecks for gene transfer. Plant Breeding methodologies, Molecular and transgenic breeding approaches. Principles and procedures in the formation of a complex population; Genetic basis of population improvement in crop plants. Selection in clonally propagated crops. Choice of molecular markers for plant breeding efficiency, fingerprinting and genetic diversity assessment, application of MAS for selection of qualitative and quantitative traits; Gene pyramiding. Genetic resource, Molecular and biochemical basis of self-incompatibility and male sterility.Breeding for climate change - abiotic stress tolerance and Biotic stress tolerance, greenhouse gases and carbon sequestration; Breeding for bio-fortification.

Unit II **14 Hours**

Introduction to the plant genomes: nuclear, chloroplast and mitochondrial genomes; Concept of genome size and complexity: C-value paradox, repetitive and unique DNA. Genome sequencing: Applications of sequence information: structural, functional and comparative genomics, Linkage and LD-based gene mapping approaches including gene/ QTL mapping, Integration of genetic and physical map for map-based cloning of economically important genes. Concept of allele mining, TILLING and ecoTILLING for crop improvement; Genome-wide and gene-specific transcriptomics approaches, Basic concepts of high-throughput proteomics, metabolomics and phenomics. Recent transgene free genome editing tools such as CRISPR-Cas9 system, TALENS and ZFNs for crop improvement. Cisgenesis and

Intragenesis tools as twin sisters for Crop Improvement; Genomics-based plant breeding

Unit III **16 Hours**

Organization and structure of genome, Genome size, Organization of organellar genomes, Nuclear DNA organization, Nuclear and Cytoplasmic genome interactions and signal transduction, Variation in DNA content - C value paradox; Sequence complexity – Introns and Exons, Repetitive sequences, Karyotyping, Tracking introgressions using FISH, GISH, localization and mapping of genes/ genomic segments. Multiple interchanges-use in producing inbreds, transfer of genes- linked marker methods; Duplication - production and use, Trisomics and Monosomics, Intervarietal substitutions-allelic and nonallelic interactions; Telocentric method of mapping. Distant hybridization.

Unit IV **13 Hours**

Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection, National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

Suggested Readings:

1Agarwal RL. 1996. Fundamentals of Plant Breeding and Hybrid Seed Production.Oxford &
IBH.
2. Allard RW.1966.Principles of Plant Breeding. JohnWiley&Sons.
3. Briggs FN & Knowles PF.1967.Introduction to Plant Breeding.Reinhold.
4. Fehr WR. 1987. Principles of Cultivar Development: Theory and Technique. Vol I.Macmillan.
5. Hayes HK, Immer FR & Smith DC. 1955. Methods of Plant Breeding. McGraw-Hill.
6. Kang MS and Priyadarshan PM (Edit.).2007. Breeding Major Food Staples. Blackwell
Publishing.
7. Kole C. 2013. Genomics and Breeding for Climate-Resilient Crops. Springer.
Volume2TargetTraits.
8. Mandal AK, Ganguli PK & Banerji SP. 1995. Advances in Plant Breeding. Vol. I, II.CBS.
9. Richards AJ.1986. Plant Breeding Systems.George Allen & Unwin.
10. Sharma JR. 1994. Principles and Practice of Plant Breeding. Tata McGraw-Hill.
11. Simmonds NW. 1979. Principles of Crop Improvement.Longman.

12. Singh BD. 1997. Plant Breeding: Principles and Methods. 5th Ed., Kalyani Publ.
13. Singh P. 1996. Essentials of Plant Breeding. Kalyani Publ.
14. Welsh JR.1981.Fundamentals of Plant Genetics and Breeding. JohnWiley.