

GURUKASHIUNIVERSITY



**Doctor of Philosophy
In
Fruit Science**

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
PPH112	Innovative Approaches in Fruit Breeding, Modern Trends in Fruit Production & abiotic stress management and Recent Developments in Growth Regulation of fruit crops	core	4	0	0	4	30	70	100
Total Credits						12	120	280	400

CourseTitle:ResearchMethodology

CourseCode:PPH101

L	T	P	Credits
4	0	0	4

Total Hours:60

LearningOutcomes

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 complementarity 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-I15 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

15Hours

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, and Statistical analysis. Components of time series, Analysis of time series, Measurement of trend, Measurement of seasonal variations.

Unit-III15 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

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

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

• **RPE 02: SCIENTIFIC CONDUCT**

5 Hours

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

• **RPE03: PUBLICATION ETHICS**

7 Hours

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 Hours

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 Hours

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 Hours

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

- Bird, A. (2006). Philosophy of Science. Routledge.
- MacIntyre, A. (1967) A Short History of Ethics. London.
- P. Chaddah, (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarized, ISBN:978-9387480865
- 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.
- 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/bioethics/whatis/index.cfm>
- 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.

Course Content

Unit I

06 Hours

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 II

08 Hours

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 III

08 Hours

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 IV

08 Hours

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

- Office 2007 in Simple Steps, Kogent Solutions, (Wiley Publishers).
- MS-Office 2007 Training Guide, S. Jain (BPB Publications).

- Computer Fundamentals by P.K. Sinha (BPB Publications).
- <https://www.mendeley.com/reference-management/reference-manager>
- <https://chat.openai.com>
- <https://edu.google.com/workspace-for-education/classroom/>

Course Title: Innovative Approaches in Fruit Breeding, Modern Trends in Fruit Production & abiotic stress management and Recent Developments in Growth Regulation of fruit crops.

Course Code: PPH112

L	T	P	Credits
4	0	0	4

Total Hours 60

Learning Outcome

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

1. Understand advanced techniques like CRISPR and genomic selection. Apply them to develop fruit varieties with enhanced traits.
2. Explore high-density orchards and precision farming. Improve sustainability and efficiency in fruit production.
3. Learn stress-tolerant strategies using rootstocks and omics. Mitigate impacts of drought, heat, and salinity.
4. Study new plant growth regulators for fruit quality. Implement precise thinning and ripening techniques.
5. Combine genomics and digital agriculture. Create resilient, high-yielding fruit crops for diverse climates.

Course Content

Unit-I

15 Hours

Current Trends and Status: Modern trends in fruit breeding –with major emphasis on precocity, low tree volume, suitability for mechanization, health benefits, etc. Inheritance Patterns and Breeding Systems: Genetics of important traits and their inheritance pattern, variations and natural selection, spontaneous mutations, incompatibility systems in fruits. Plant Architecture, Stress Tolerance and Fruit Quality: Recent advances in crop improvement efforts- wider adaptation, plant architecture, amenability to mechanization, fruit quality attributes, stress tolerance, crop specific traits; use of apomixis, gene introgression and wide hybridization (alien genes). Transgenic, Markers and Genomics: Molecular and transgenic approaches in improvement of selected fruit crops; fast track breeding – marker assisted selection and breeding (MAS and MAB), use of genomics

and gene editing technologies.

Unit-II

15 Hours

General Concepts and Current Scenario: National and International scenario, national problems. Propagation, Planting Systems and Crop Regulation: Recent advances in propagation – root stocks, planting systems, High density planting, crop modeling, Precision farming, decision support systems – aspects of crop regulation- physical and chemical regulation. Overcoming Stress and Integrated Approaches: Effects on physiology and development, influence of stress factors, strategies to overcome stress effects, integrated and modern approaches in water and nutrient management, Physiological disorders, Total quality management (TQM) – Current topics.

Unit-III

15 Hours

Mitigation Measures and Conservation Practices: Greenhouse effect and methane emission and its relevance to abiotic stresses, use of anti transpirants and PGRs in stress management, mode of action and practical use, HSP inducers in stress management techniques of soil moisture conservation, mulching, hydrophilic polymers. Rain water harvesting, increasing water use efficiency, skimming technology, contingency planning to mitigate different stress situations, stability and sustainability indices.

Unit-IV

15 Hours

Current Concepts and Principles: Eco-physiological influences on growth and development of fruit crops-flowering, fruit set- Crop load and assimilate partitioning and distribution. Phytohormones and Growth Regulators: Root and canopy regulation, study of plant growth regulators in fruit culture-structure, biosynthesis, metabolic and morphogenetic effects of different plant growth promoters and growth retardants. Absorption, translocation and degradation of phytohormones – internal and external factors influencing hormonal synthesis, biochemical action, growth promotion and inhibition, canopy management for fertigated orchards. Regulation of Developmental Processes: Growth regulation aspects of propagation, embryogenesis, seed and bud dormancy, fruit bud initiation, regulation of flowering, off season production. Flower drop and thinning, fruit-set and development, fruit drop, parthenocarpy, fruit maturity and ripening and storage, molecular approaches in crop growth regulation- current topics.

Crops

Mango, banana, guava, papaya, Citrus, grapes, pomegranate, litchi, apple, pear, strawberry, kiwifruit, plums, peaches, apricot, cherries, nectarines,

nut crops.

Suggested readings:

- Al-Khayari J, Jain SN and Johnson DV. 2018. Advances in Plant Breeding Strategies. Vol. 3: Fruits. Springer.
- Badenes S and Byrne DH. 2012. Fruit Breeding. Springer.
- Hancock JF. 2008. Temperate Fruit Crop Breeding: Germplasm to Genomics. Springer.
- Kole C and Abbott AG. 2012. Genetics, Genomics and Breeding of Stone fruits. CRC.
- Kole, C. 2011. Wild Crops Relatives: Genomics and Breeding Resources: Tropical and Subtropical Fruits. Springer-Verlag.
- Kole C. 2011. Wild Crops Relatives: Genomics and Breeding Resource: Temperate Fruits. Springer-Verlag.
- Jain SN and Priyadarshan PM. 2009. Breeding Plantation and Tree Crops: Tropical Species; Temperate Species. Springer -Verlag.
- Janick J and Moore JN, 1996. Fruit Breeding. Vols.I-III. John Wiley & Sons, USA.
- Orton T. 2019. Methods in Fruit Breeding. Elsevier.
- Singh SK, Patel VB, Goswami AK, Prakash J and Kumar C. 2019. Breeding of Perennial Horticultural Crops. Biotech Books. Delhi.
- Bartholomew DP, Paull RE and Rohrbach KG. eds. 2002. The Pineapple: Botany, Production, and Uses. CAB International.
- Bose TK, Mitra SK and Sanyal D. Eds. 2002. Fruits of India – Tropical and Sub- Tropical. 3rd Ed. Vols. I, II. NayaUdyog, Kolkata, India.
- Dhillon WS and Bhatt ZA. 2011. Fruit Tree Physiology. Narendra Publishing House, New Delhi.
- Dhillon WS. 2013. Fruit Production in India. Narendra Publishing House, New Delhi.
- Gowen S. 1995. Bananas and Plantains. Chapman & Hall Publication, US.
- Litz RE. ed. 2009. The Mango: Botany, Production and Uses. CAB International.
- Peter KV. 2016. Innovations in Horticulture. NIPA, New Delhi.
- Robinson JC and Saúco VG. 2010. Bananas and Plantains (Vol. 19). CAB International.
- Samson JA. 1980. Tropical Fruits. Longman, USA.
- Sharma RR and Krishna H. 2014. Fruit Production: Major Fruits. Daya Publishing House, Delhi.
- Singh S, Shivankar VJ, Srivastava AK and Singh IP. 2004. Advances in Citriculture. Jagminder Book Agency, New Delhi.
- Stover RH and Simmonds NW. 1991. Bananas. Longman, USA.

- Chadha KL, Ahmed N, Singh SK and Kalia P. 2016. Temperate Fruits and Nuts- Way Forward for Enhancing Production and Quality. Daya Publishing House, New Delhi.
- Childers NF, Morris JR and Sibbett GS. 1995. Modern Fruit Science: Orchard and Small Fruit Culture. Horticultural Publications, USA.
- Erez A. 2013. Temperate Fruit Crops in Warm Climates. Springer Science.
- Jackson D, Thiele G, Looney NE and Morley-Bunker M. 2011. Temperate and Subtropical Fruit Production. CAB International.
- Ryugo K. 1998. Fruit Culture: Its Science and Art. John Wiley & Sons, USA.
- Tromp J, Webster AS and Wertheim SJ. 2005. Fundamentals of Temperate Zone Tree Fruit Production. Backhuys Publishers, Lieden, The Netherlands.
- Westwood MN. 2009. Temperate Zone Pomology: Physiology and Culture. 3rd Edn. Timber Press, USA.
- Bhatnagar P. 2017. Physiology of Growth and Development of Horticultural Crops. Agrobios (India).
- Buchanan B, Gruissem W and Jones R. 2002. Biochemistry and Molecular Biology of Plants. John Wiley & Sons, US.
- Fosket DE. 1994. Plant Growth and Development: A Molecular Approach. Academic Press, USA.
- Leopold AC and Kriedemann PE. 1985. Plant Growth and Development. 3rd Ed. McGraw-Hill, US.
- Richard N. Artica. 1995. Plant Growth Substances – Principles and Applications. Chapman & Hall, USA.
- Roberts J, Downs S and Parker P. 2002. Plant Growth Development. In: Plants (I. Ridge, Ed.), Oxford University Press.
- Salisbury FB and Ross CW. 1992. Plant Physiology. 4th Ed. Wadsworth Publication.
- Blumm A. 1988. Plant Breeding for Stress Environments. CRC Publication, USA. Christiansen,
- MN and Lewis CF. 1982. Breeding Plants for Less Favourable Environments. Wiley International Science, USA.
- Kanayama Y and Kochetor. 2015. Abiotic Stress Biology in Horticultural Plants. Springer.
- Kramer PJ. 1980. Drought Stress and the Origin of Adaptation. In: Adaptation of Plants to Water and High Temperature Stress. John Wiley & Sons, USA.
- Maloo SR. 2003. Abiotic Stress and Crop Productivity. Agrotech Publ. Academy, India.

- Nickell LG. 1983. Plant Growth Regulating Chemicals. CRC Publication, USA.
- Rao NKS, Shivashankar KS and Laxman RH. 2016. Abiotic Stress Physiology of Horticultural Crops. Springer.
- Turner NC and Kramer PJ. 1980. Adaptation of Plants to Water and High Temperature Stress. John Wiley & Sons, USA.

