

GURU KASHI UNIVERSITY



**Doctor of Philosophy
In
Soil Science**

Session: 2025-26

Faculty of Agriculture

Program Structure										
Sr. No	Course Code	Course Title	Course Type	L	T	P	Credits	Internal	External	Total Marks
1	PPH101	Research Methodology	Core	4	0	0	4	30	70	100
2	PPH102	Research and Publication Ethics	Core	2	0	0	2	30	70	100
3	PPH141	Advances in Soil Physics, Fertility & Chemistry of Soil, Soil Genesis and Land use Evaluation & Planning	Core	4	0	0	4	30	70	100
4	PPH104	Computer Applications in Research	SkillBased	0	0	4	2	30	70	100
Total				10	0	4	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 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-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 Hours**
 1. Introduction to philosophy: definition, nature and scope, concept, branches
 2. Ethics: definition, moral philosophy, nature of moral judgments 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
- **RPE 03: 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 contributor ship
 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 Hrs.)**
 - A. Group Discussions** **2 Hours**
 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 Hours**

Use of plagiarism software like Turnitin, Urkund and other open source software tools
- **RPE 06: DATABASES AND RESEARCH METRICS (7 Hrs.)**
 - A. Databases** **4 Hours**
 1. Indexing databases
 2. Citation databases: Web of Science, Scopus etc.
 - B. Research Metrics** **3 Hours**
 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/bioethics/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 Soil Physics, Fertility & Chemistry of Soil, Soil Genesis and Land use Evaluation & Planning
Course Code: PPH141

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	To know about various processes (Soil water interaction, theories of water and salt movement, potential concept) in soil science.
2	Understand the mechanism of colloidal chemistry, nutrient absorption and their movement, nutrient availability indices and concept of fertilizer recommendation to crop.
3	To suggest remedial measures to reclaim salt – affected soils
4	To evaluate the soils potentials for different cropping systems and land use.

Theory

UNIT I

17 Hours

Soil water potential, free energy and thermodynamic basis of potential concept, chemical potential of soil water and entropy of the system. Development of differential equations in saturated and unsaturated water flow, capillary conductivity and diffusivity. Limitations of Darcy's law. Numerical solution for one dimensional water flow. Theories of horizontal and vertical infiltration under different boundary conditions. Movement of salts in soils, models for miscible-immiscible displacement, diffusion, mass flow and dispersion of solutes and their solutions through differential equations. Break-through curves. Thermal properties of soil, heat transfer in soils, differential equation of heat flow, and measurement of thermal conductivity of soil. Structural management of puddled rice soils. Soil conditioners - significance in agriculture. Solar and terrestrial radiation measurement, dissipation and distribution in soil-crop systems. Prediction of evapotranspiration using aerodynamic and canopy temperature-based models. Leaf diffusion resistance in relation to plant water deficit.

UNIT II

16 Hours

Modern concepts of nutrient availability. Soil solution and plant growth. Nutrient

response functions and availability indices. Nutrient movement in soils, absorption by plants. Mechanistic approach models to nutrient supply and uptake by plants. Models for transformation and movement of major micronutrients in soils. Chemical equilibrium involving nutrient ions in soils, particularly in submerged soils. Modern concepts of fertilizer application, evaluation, nutrients use efficiency and nutrient budgeting. Soil fertility evaluation techniques. Role of soil tests in fertilizer use recommendations. Site - specific nutrient management for precision agriculture. Monitoring physical, chemical and biological changes in soils. Permanent manurial trials. Soil productivity under long term intensive cropping- direct, residual and cumulative effects of fertilizer use. Colloidal chemistry of inorganic and organic components of soils - their formation, clay organic interaction. Predictive approaches for cation exchange equilibria - thermodynamics, empirical and diffuse double layer theory, relationships among different selectivity coefficients. Structure and properties of diffuse double layer. Thermodynamics of nutrients transformation in soils. Cationic and anionic exchange and their models, molecular interaction.

UNIT III

14 Hours

Pedogenic evolution of soil. Soil composition and characterization. Weathering and soil formation factors and pedogenic processes. Thermodynamics of mineral stability and weathering sequences of minerals. Assessment of soil profile development by mineralogical and chemical analysis. Micro - pedological features of soils - their structure, fabric analysis, role in genesis and classification. Organic matter- pools, composition and distribution in soils and its functions. Environmental significance of humic substances. Decomposition of organic residues in soil in relation to organic matter pools. Biochemistry of the humus formation and different pathways for humus synthesis in soil. Soil carbohydrates and lipids. Nutrient transformations - N, P, and S. Trace metal interaction with humic substances, Significance of chelation reactions in soils.

UNIT IV

13 Hours

Concept and techniques of land use planning. Factors governing present land use. Land evaluation methods and soil-site suitability evaluation for different crops, land capability classification and constraints in application. Agro - ecological regions / sub - regions of India and their characteristics in relation to crop production. Water harvesting - concept, significance, types, methodology and use of harvested water in agriculture to increase water productivity. Watershed development / management - concept, objectives, characterization. Planning, execution, community participation and evaluation. Rehabilitation of watershed. Developing economically and ecologically sustainable agro - forestry systems for watershed through Participatory Rural Appraisal (PRA) and case studies.

Suggested Readings:

1. ISSS 2009. *Fundamentals of Soil Science*. Indian Society of Soil Science, New Delhi.
2. Brady, N.C., Weil, R.R. 2016. *The Nature and Properties of Soils*. Pearson.
3. Lal, R., Blum, W.E.H., Valentine, C. and Stewart, B.A. (Editors) 1988. *Methods for Assessment of Soil Degradation*. CRC Press, Boca Raton.
4. FAO 1996. *Land Quality Indicators and their Use in Sustainable Agriculture and Rural Development*. FAO Land and Water Bulletin.5. FAO, Rome.
5. ISSS 1994. *Management of Land and Water Resources for Sustainable Agriculture and Environment*. Diamond Jubilee Symposium Publication, Indian Society of Soil Science, New Delhi.
6. Sehgal, J. 1996. *Pedology: Concepts and Application*. Kalyani publishers, New Delhi.
7. SSSA 1996. *Methods for Assessing Soil Quality*. SSSA Publication Number 49, Madison, Wisconsin, USA.