

GURU KASHI UNIVERSITY



Doctor of Philosophy

Session: 2025-26

**Faculty of Sciences, Humanities and
Languages**

Department of Mathematics

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	PPH124	Recent Advances in Mathematics	Core	4	0	0	4	30	70	100
4	PPH104	Computer Applications in Research	Skill Based	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 Hrs.)**

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 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
4. Journal finder / journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggested, 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/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: Research Advances in Mathematics
Course Code: PPH124

L	T	P	Credits
4	0	0	0

Total Hours 60

COURSE LEARNING OUTCOMES: On completion of this course, the successful students will be able to:

1. Analyze surfaces and curves in two /three-dimension space and able to Comprehend the Euler equations, the Bessel equation and Regular singular points at infinity. Evaluate solutions of the Homogeneous equation with constant co-efficient and applications of Paffin's and Picard's methods etc.
2. Represent periodic functions using Fourier series, get an idea of power series method to solve differential equations, will be familiar with Legendre equation and Legendre polynomial, express a periodic function by Fourier series and a non-periodic function by Fourier transform, to analyze the displacements of one-dimensional wave and distribution of one-dimensional heat equation.
3. Predict the behavior of a given physical system based on the analysis of its mathematical model and capable to solve that, formulate simple stochastic process models in the time domain and provide qualitative and quantitative analyses of such models.
4. Gather basic knowledge about stochastic processes in the time domain and will acquire more detailed knowledge about Markov processes with a discrete state space, including Markov chains, Poisson processes and birth and death processes. Also accumulate the knowledge about queueing systems and Brownian motion, in addition to mastering the fundamental principles of simulation of stochastic processes and the construction of Markov chain Monte Carlo (MCMC) algorithms.

COURSE CONTENT

UNIT-I

15 Hours

Differential Equations: Differential Equations, Types of Differential Equations in more than two variables, Simultaneous Differential equations, Paffin Differential forms and Boundary value Problems. Uniqueness and Existence of Differential Equations, Application of Differential Equations, Simulation technique. Numerical analysis: curve fitting, interpolation and their solving methods.

UNIT-II

15 Hours

Fourier Series: Expansion in an arbitrary period- Half range expansion. Wave lets- The Haar wavelets- A wavelets expansion- General construction of wavelets and multi resolution analysis- Shannon wavelets. Fourier integral formula- Fourier transform- Inverse Theorem for complex Fourier transform- Fourier sine and cosine transform- Inversion Formulae Convolution theorem for Fourier transform- Parseval's Identity-

Finite Fourier sine and cosine Transform- Inversion formulae- Application of integral equations and boundary value problem.

UNIT-III

15 Hours

Mathematical Modelling: Introduction to Mathematical modelling, Solving techniques, classification. Application of Mathematical modelling through various mathematical techniques like mathematical Programming, Numerical Analysis, Probability & Statistical Model. Application of Mathematical calculus in daily life. Introduction to Matrix, Eigen value & Eigen vector of characteristic equation.

UNIT-IV

15 Hours

Inventory Models: Types of Inventories, Inventory Decisions, Classification of Inventory Models, Concept of Average inventory, Economic Ordering Quantity (EOQ), EOQ with shortages and without shortages, EOQ with constraints. Dynamic or Fluctuating Demand Models, Re-order level – Optimum Buffer stock – Inventory Control System – Deterministic Models with Price- Breaks. Probabilistic Inventory Models, Instantaneous Demand, No Set- up cost Model, Uniform Demand- No Set- up cost Model, Probabilistic order level system with constant lead Time, Multi period Probabilistic model with constant lead Time.

Transaction Mode-Video Based Teaching, Collaborative teaching, Ted Teaching, E-Team teaching, Flipped teaching.

SUGGESTED READINGS

1. L. W. Beinke and R. J. Wilson. (2004). *Algebraic Graph Theory*. Cambridge University Press.
2. George Bachman, Lawrence Narici and Edward Beakenstein. (2000). *Fourier and Wavelet Analysis*. Springer-Verlag, New York.
3. Richard L. Wheeden and Antoni Zygmund. (2015). *Measure and integral*. Marcel Dekker Inc., New York.
4. Balmohan V. Limaye. (2014). *Functional Analysis*, New Age International (P) Ltd. New Delhi.
5. David Roxbee Cox & David Victor Hinkley (1982). *Theoretical statistics*. Chapman and Hall.
6. Shao Jun. (2003). *Mathematical Statistics*. 2nd Edition, Springer.
7. Deepak Kumar, Vinod Kumar, Pooja Khurana (2021). *Analysis of Epidemiology: Integrating Computational Models – First Edition*, Taylor Francis: Apple Academic Press, e-ISBN: 978100308203.
8. Lehmann, E.L. (1990). *Testing statistical hypothesis*. 2nd Ed. New York: Wiley.

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**

- 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/>