

Syllabus for Course Work

Ph.D. in Geology



Effective from 2020-21

Rajiv Gandhi University

Rono Hills, Doimukh
Arunachal Pradesh - 791112



Syllabus for Course Work: Ph.D. in Geology

Course Code	Course Title	Credit
GLR-611	Research Methodology	4
GLR-612	Research and Publication Ethics	2
GLR-613	Geological Techniques	4
Total Credits		10



GLR-611

Research Methodology

Total Credit: 4

Total marks: 100

(Sessional: 25, End-semester: 75)

Objective

The main objective of the course is to introduce the students to the fundamentals of scientific research including identification of research problem, research planning, research design, use of statistical tools and computer application in geoscientific research.

Course Outcome

On completion of the course, the students are expected to understand the techniques of research, various stages of performing geoscientific research, applications of statistics and computer programme in performing research, process of writing thesis and research paper.

Unit 1: Fundamentals of scientific research; types of research; identification and definition of research problem; concepts and development of hypothesis, assessing a research problem; review of literature; significance and status of research in geology.

Unit 2: Basic concepts of research design; principles of experimental design; developing a research plan; types of data; methods of data collection; sampling; processing and analysis of data; data display and interpretation; developing a research proposal in geology.

Unit 3: Writing research report and scientific paper; peer review process for journals; writing a Ph.D. thesis; structure of thesis; organizing thesis; abstract and summary writing in thesis.

Unit 4: Basic mathematical and statistical methods; correlation and regression; trend surface analysis; cluster analysis; principal component analysis (PCA), Markov chain analysis; test of significance: z-test, t-test, F-test, chi-square (χ^2) test.

Unit 5: Fundamentals of computer; operating system (DOS, Windows, LINUX); common application software; open source software; application software used in geology: (for bivariate, multivariate, log-probability plots, plotting geochemical, structural and hydrogeological data; for preparation of lithology and correlation).

Recommended Books

Text Books

1. **Fundamental of Research Methodology and Statistics** - Yogesh Kumar Singh, *New Age Publications*
2. **Research Methodologies for Beginners** - Kitsakorn Locharoenrat, *CRC Press*
3. **Research Methodology: A Step-by-Step Guide for Beginners** - Ranjit Kumar, *Sage Publications*
4. **Research Methodology: Methods and Techniques** - C. R. Kothari, *New Age Publications*
5. **Statistics and Data Analysis in Geology** - J. C. Davis, *Wiley India*
6. **Thesis Writing for Master's and Ph.D. Program** - Subhash Chandra Parija and Vikram Kate, *Springer*

Reference Books

1. **A Concise Guide to Writing a Thesis of Dissertation: Educational research and Beyond** - Halyna M. Kornuta and Ron W. Germaine, *Routledge*
2. **Authoring a PhD: How to Plan, Draft, Write and Finish a Doctoral Thesis or Dissertation** - Patrick Dunleavy, *Palgrave Macmillan*
3. **McGraw-Hill's Concise Guide to Writing Research Papers** - Carol Ellison, *McGraw-Hill*
4. **Research Design: Qualitative, Quantitative, and Mixed Method Approaches** - John W. Creswell, *Sage Publications*
5. **Research Methodology: The Aims, Practice and Ethics of Science** - Peter Pruzan, *Springer*



GLR-612

Research and Publication Ethics

Total Credit: 2

Total marks: 100

(Sessional: 25, End-semester: 75)

Objective

The main objective of the course is to introduce the students to research and publication ethics and misconducts.

Course Outcome

On completion of the course, the students are expected to be learnt ethics in research and in publication, copyright, plagiarism, sources of errors and results of misconduct in the research career.

- Unit 1: **PHILOSOPHY AND ETHICS:** Introduction to philosophy - definition, nature and scope, concept, and branches; Ethics: definition, moral philosophy, nature of moral judgements and reactions.
- Unit 2: **SCIENTIFIC CONDUCT:** Ethics with respect to science and research; intellectual honesty and research integrity; scientific misconducts - falsification, fabrication, and plagiarism (FFP); redundant publications - duplicate and overlapping publications, salami slicing; selective reporting and misrepresentation of data.
- Unit 3: **PUBLICATION ETHICS:** Publication ethics - definition, introduction and importance; best practices / standards setting initiatives and guidelines - COPE, WAME, etc.; conflicts of interest; publication misconduct - definition, concept, problems that lead to unethical behavior and vice versa, types; violation of publication ethics, authorship and contributorship; identification of publication misconduct, complaints and appeals; predatory publishers and journals.
- Unit 4: **OPEN ACCESS PUBLISHING:** Open access publications and initiatives; SHERPA/RoMEO online resource to check publisher copyright and self-archiving policies; software tool to identify predatory publications developed by SPPU; journal finder / journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.
- Unit 5: **PUBLICATION MISCONDUCT:** Group Discussions - subject specific ethical issues, FFP, authorship; conflicts of interest; complaints and appeals: examples and fraud from India and abroad; Software tools - use of plagiarism software like Turnitin, Urkund and other open source software tools.
- Unit 6: **DATABASES AND RESEARCH METRICS:** Databases - indexing databases; citation databases: Web of Science, Scopus, etc. Research Metrics - Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score; Metrics: h-index, g index, i10 index, altmetrics.

Recommended Books

Text Books

1. **Ethics in Science: Ethical Misconduct in Scientific Research** - John D'Angelo, *CRC Press*
2. **Research Methodology: The Aims, Practice and Ethics of Science** - Peter Pruzan, *Springer*
3. **The Student's Guide to Research Ethics** - Paul Oliver, *Open University Press*

Reference Books

1. **Philosophy in Educational Research: Epistemology, Ethics, Politics and Quality** - David Bridges, *Springer*
2. **McGraw-Hill's Concise Guide to Writing Research Papers** - Carol Ellison, *McGraw-Hill*
3. **Textbook of Research Ethics: Theory and Practice** - Sana Loue, *Springer*
4. **Scientific Integrity and Research Ethics: An Approach from the Ethos of Science** - David Koepsell, *Springer*



GLR-613

Geological Techniques

Total Credit: 4

Total marks: 100

(Sessional: 25, End-semester: 75)

Objective

The main objective of the course is to introduce the students to the advanced field and laboratory techniques in geoscientific research.

Course Outcome

On completion of the course, the students are expected to be learnt the basic and advanced tools and techniques used both in laboratory and in the field. They will also be able integrate and interpret various types of geological data to solve research problems in geosciences.

Unit 1: Preparation of pre-field map; field mapping in igneous, sedimentary and metamorphic terrain; field data collection and documentation; sampling procedure; modern and conventional mapping and sampling tools; Preparation of litholog and geological sections.

Unit 2: Laboratory techniques in geology: preparation of thin sections and polished sections/blocks of minerals, rocks and ores; thin section preparation techniques for loose sediments and heavy minerals; staining techniques, petrography and ore microscopy; SEM.

Unit 3: Analytical methods and tools in geology; concepts in chemical analysis of rocks; rock reference materials; selecting suitable analytical techniques; reporting analytical data; advanced laboratory techniques: X- ray diffraction method, X-ray fluorescence spectrometry, emission and absorption spectrometry, mass spectrometry, EPMA and ion microprobe analysis; Raman spectroscopy and its applications in earth sciences.

Unit 4: Dating methods in geology; relative and absolute dating-tools and techniques; interpretation of geochronological data, dating techniques for Quaternary events/sediments; use of stable isotopes in geological interpretation.

Unit 5: Processing and interpretation of satellite data for geological and geomorphic information; use of GPS and GIS techniques in field mapping and documentation.

Recommended Books

Text Books

1. **A Handbook of Silicate Rock Analysis** - P. J. Potts, *Blackie Academic & Professional*
2. **An Introduction to Geographical Information Systems** - I. Heywood, S. Cornelius and S. Carver, *Pearson*
3. **Basic Geological Mapping** - R. J. Lisle, Peter Brabham and John Barnes, *Wiley-Blackwell*
4. **Geological Structures and Maps: A Practical Guide** - R. J. Lisle, *Elsevier*
5. **Global Positioning System: Concept, Technique and Application** - A. Rahman and S. Fazal, *New Age International*
6. **Handbook of Mineral Exploration and Ore Petrology: Techniques and Applications** - R. Dhana Raju, *Geological Society of India*
7. **Introduction to Optical Mineralogy** - William D. Nesse, *Oxford University Press*
8. **Isotope Geology** - C. J. Allegre, *Cambridge University Press*
9. **Principles of Radiometric Dating** - K. Gopalan, *Cambridge University Press*
10. **Quaternary Dating Methods** - Mike Walker, *Wiley*
11. **Raman Microscopy: Developments and Applications** - G. Turrell and J. Corset (Eds.), *Elsevier*
12. **Remote Sensing and Image Interpretation** - T. M. Lillesand, R. W. Kiefer and J. W. Chipman, *John Wiley and Sons*

Reference Books

1. **Aspects of Multivariate Statistical Analysis in Geology** - R. A. Reyment and E. Savazzi, *Elsevier*
2. **Guide to Thin Section Microscopy** - M. M. Raith, Peter Raase and Jurgen Reinhardt, *ISBN 978300037671*
3. **Image Interpretation in Geology** - S. A. Drury, *Nelson Thornes*
4. **Introduction to Geochemical Modeling** - Francis Albarede, *Cambridge University Press*
5. **Isotope Geology** - A. P. Dikkins, *Cambridge University Press*
6. **Optical Mineralogy: Principles and Practices** - C. D. Gribble and A. J. Hall, *George Allen & Unwin*
7. **Remote Sensing Geology** - R. P. Gupta, *Springer-Verlag*
8. **Sedimentary Rocks in the Field: A Colour Guide** - D. A. V. Stow, *Manson Publishing*
9. **The Field Description of Igneous Rocks** - D. Jerram and N. Petford, *Wiley-Blackwell*
10. **The Field Description of Metamorphic Rocks** - N. Fry, *Wiley-Blackwell*
11. **Using Geochemical Data: Evaluation, Presentation, Interpretation** - H. Rollinson, *Longman Scientific & Technical*