

MANGALORE UNIVERSITY
DEPARTMENT OF CHEMISTRY,
Mangalagangothri-574199

Ph.D. Course work in Chemistry
Revised Syllabi



PROGRAMME OUTCOMES

The PhD program in Chemistry provides highly trained manpower:

- With the in-depth knowledge in chemistry field with sufficient background in related fields through advanced course work and laboratory research to actively participate in the development and growth of chemistry at all levels in the industry or in research and teaching in a university or a research organization.
- With good understanding and awareness of professional, ethical and safety applications of their knowledge for the advancement of the society.
- Able to demonstrate originality in the application of knowledge, together with a practical understanding of how research is used to create and interpret knowledge in their field.
- Capable of carrying out independent research with competency in research design, data gathering and interpretation, and communication of research results through scientific publications in peer reviewed scientific journals and scientific presentations.

PROGRAMME SPECIFIC OUTCOMES

- Develop in depth knowledge of various fundamental and advanced aspects, understanding and expertise in the chemical science and field of able to apply them to advanced studies.
- Acquire sound knowledge in classical laboratory techniques and modern instrumentation to perform new experiments, obtain experimental data and its interpretation through theoretical principles.
- Understand the access, search and the use of chemical literature.
- Gain ability to integrate knowledge gained in Chemistry to various academic, Industry and Pharmaceutical needs.
- Provide opportunity to propagate chemical knowledge through presentations and discussion in chemistry forums and publication of research findings.
- Give opportunities to excel in academics, research or Industry
- Demonstrate professionalism in teaching, industries and research through ethical principles
- Undertake the setting up of small scale industries with the available resources.

Paper -1: CH 601: Research Methodology in Chemistry (56 hrs.)

COURSE OUTCOMES

Enable the students:

- To learn about the foundation of research, types and methods of research, literature survey and planning of research
- To understand the research problem and sampling techniques or methods
- To acquire knowledge of computer system, softwares, application and uses of common softwares in chemistry.\
- To know about the chemical safety and ethical handling of chemicals.
- To understand the advanced techniques of analysis such as UV-Vis, IR, NMR, Mass, ESR spectroscopy, XRD, thermal and electrochemical analysis and ethics of research.

UNIT-I: Foundation of Research- What is Research? Objectives of Research, Scientific Research, Research and Theory-Conceptual and theoretical Models-Importance of research methodology in scientific research. Research design, Basic Principles- Need of research design, Features of good design, important concepts relating to research design.

Types and Methods of Research, Classification of Research, Pure and Applied Research, Exploring or Formulative Research, Descriptive Research, Diagnostic Research/Study, Evaluation research/Studies, Action Research, Experimental Research-Problem selection, Literature Survey : Sources of information, Need for Reviewing Literature, Primary, Secondary, Tertiary sources, Journals, Journal abbreviations, Abstracts, Current titles, Reviews: Monographs, Dictionaries, Text books, Current contents, Introduction to Chemical Abstracts and Beilstein, Subject Index, Substance Index, Author Index, Formula Index and other Indices with examples. Digital: Web resources, E-Journal, Journal access, TOC alerts. Hot articles: Citation index, Impact factor, H-Index, E-Consortium, UGC infonet, E-Books, Internet discussion groups and communities, Blogs, Preprint server, Search engines, Scirus, Google Scholar, Chemical Industry, Wiki- Databases, ChemSpider, ScienceDirect, SciFinder, Scopus. Familiarity with ideas and concepts of investigation. Field Studies. Planning of Research- The planning process- Selection of a Problem for Research- Formulation of the Selected Problems- Hypothesis formation- Measurement-Research Design/Plan. 14hrs.

UNIT-II: Research problem-Identification, statement of research problem, objectives, design and execution of experiments, collection and interpretation of experimental data, arriving at conclusions. Reporting the results of research-style and format - title, abstract and the text. References, tables, figures, elucidations, quotations and footnote. Writing of monographs, review articles and dissertations.

Sampling Techniques or Methods- Choice of sampling Techniques-Sample size- Sampling and Non-Sampling errors- Estimation of Population and Proportion, Mean- Estimation of Standard Error and Confidence Interval. Errors and statical analysis of Data, Classification of errors, statistical analysis of errors, Curve fitting and Tests of statistical significance. 14hrs.

UNIT-III: Basic knowledge of computer systems, softwares - System software and application software, Programming languages: machine language, assembly language and high level

languages. Interpreter and compiler. Flow charts and Algorithms. General awareness of operating systems: Disk operating system, Windows, Macintosh, Linux. General awareness of Software packages and other scientific application. Application and uses of common softwares in chemistry, Origin, Chems sketch, Chemdraw. Basic ideas on the use of Internet in Chemistry education.

Concepts of Chemical safety- Chemical Safety and Ethical Handling of Chemicals, Safe working procedure and protective environment, protective apparel, emergency procedure and first aid, laboratory ventilation, Safe storage and use of hazardous chemicals, procedure for working with substances that pose hazards, flammable or explosive hazards, procedures for working with gases at pressures above or below atmospheric, safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals, procedure for laboratory disposal of explosives, identification, verification and segregation of laboratory waste, disposal of chemicals in the sanitary sewer system, in incineration and transportation of hazardous chemicals. 14hrs

UNIT-IV: Advanced Techniques of Analysis and Ethics of Research: Applications of UV-Visible, IR, NMR, Mass, ESR, XRD for the structural elucidation of compounds. COSY, NOSEY, INDOR and DEPT spectra, Thermal analysis and electrowork station.

Ethical issues, ethical committees, Commercialization, Copy right, royalty, Intellectual property rights and patent law, Trade Related aspects of Intellectual Property Rights, Reproduction of published material. Plagiarism. Citation and acknowledgement. Reproducibility and accountability.

Safety rules of laboratory acquaintance of experimental set up and instruments. Intellectual property and intellectual property rights. Environmental impacts, Data management, importance of safety and security of data, evaluation of inventions. Communication with patent council and publication of data, communication with investors, IP sales process. 14hrs

REFERENCES:-

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RB SA Publishers.
 2. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. .
 3. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Publications. 2 volumes.
 4. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing.
 5. Wadehra, B.L. 2000. Law relating to patents, trade marks, copyright designs and geographical indications. Universal Law Publishing.
 6. Madric and Donevan, Understanding Computers, McGraw Hill.
 7. K.V. Raman, Computers in Chemistry, Tata McGraw Hill, 1993.
 8. P Lykose, Personal Computers in Chemistry, John Wiley and Sons, New York, 1981.
 9. Ramesh Kumari, Computers and their applications to Chemistry, 2nd Ed., Alpha Sci.
 10. Biggs Pete, Computers in Chemistry, Oxford University Press, 2000
 11. Chemical Safety Matters-IUPAC –IPCS, Cambridge Univ. Press, 1992.
 12. Fundamental of Research Methodology and Statistics, Yogesh Kumar Singh, New Age International Publishers, 2006.
 13. Jeffrey A. Lee, The scientific Endeavor-Methodology and Perspectives of Science, Pearson
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Paper -2: CH 602: Review of Literature-(3 hrs of Instruction per week)
COURSE OUTCOMES

Enable the students:

- To learn the review of literature about the developments in the fields of synthetic organic chemistry, heterocyclic chemistry, medicinal chemistry, structural chemistry, analytical chemistry, polymer chemistry and polymer composites.
- Conduct a thorough literature review and provide a properly referenced written report to acquire thorough knowledge of the literature and a comprehensive understanding of scientific methods and techniques applicable to their own research.
- To understand the analysis of research work, compilation and presentation of past work in the respective field and design of new research in the chosen area.

Content is based on the research field under the direction of the Research Guide. Content of the Review report shall include the art of research work analysis, related implementation issues and motivation for the stated research work.



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Ph.D. Course Work – 2
Title: Research and Publication Ethics

ANNEXURE

Course Title:

- **Research and Publication Ethics (RPE)**-Course for awareness about the publication ethics and publication misconducts.

Course Level:

- 2 Credit course (30 hrs.)

Eligibility:

- M.Phil., Ph.D. students and interested faculty members (It will be made available to post graduate students at later date)

Fees:

- As per University Rules

Faculty:

- Interdisciplinary Studies



Qualifications of faculty members of the course:

- Ph.D. in relevant subject areas having more than 10 years' of teaching experience

About the course

Course Code: CPE- RPE

Overview

- This course has total 6 units focusing on basics of philosophy of science and ethics, research integrity, publication ethics. Hands-on-sessions are designed to identify research misconduct and predatory publications. Indexing and citation databases, open access publications, research metrics (citations, h-index, Impact Factor, etc.) and plagiarism tools will be introduced in this course.

Pedagogy:

- Class room teaching, guest lectures, group discussions, and practical sessions.

Evaluation

- Continuous assessment will be done through tutorials, assignments, quizzes, and group discussions. Weightage will be given for active participation. Final written examination will be conducted at the end of the course.

- The course comprises of six modules listed in table below. Each module has 4-5 units

Modules	Unit title	Teaching hours
Theory		
RPE 01	Philosophy and Ethics	4
RPE 02	Scientific Conduct	4
RPE 03	Publication Ethics	7
Practice		
RPE 04	Open Access Publishing	4
RPE 05	Publication Misconduct	4
RPE 06	Databases and Research Metrics	7
	Total	30

Syllabus in detail

THEORY

- 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 (5hrs.)**

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 Suggester, etc.

• **RPE 05: PUBLICATION MISCONDUCT (4hrs.)**

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 (7hrs.)**

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

References

- Bird, A. (2006). *Philosophy of Science*. Routledge.
- MacIntyre, Alasdair (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.
- Resnik, 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/research/resources/bioethics/whatis/index.cfm>
- Bcall, J. (2012). Predatory publishers are corrupting open access. *Nature*, 489(7415), 179–179. <https://doi.org/10.1038/489179a>
- Indian National Science Academy (INSA), *Ethics in Science Education, Research and Governance*(2019), ISBN:978-81-939482-1-7. http://www.insaindia.res.in/pdf/Ethics_Book.pdf