

DEPARTMENT OF CHEMISTRY
NAGALAND UNIVERSITY



SYLLABUS
FOR
Ph.D. COURSE WORK

IN
CHEMISTRY

Revised : 2021

**Latest Revision: 2022 [Approved by 36th Academic Council
(AC:36:5:7) held on 17th May, 2023]**

Ph.D. COURSE WORK

SYLLABUS

Total Credit- 15 credit

Total Duration: One semester

Course Number : CHEM-601, CHEM-602, CHEM-603

Semester	Course Number	Course Name	Credit/Marks
I	CHEM – 601	Research Methodology and Research Ethics	5 Credit/100
	CHEM – 602	Analytical and Spectroscopic Techniques in Chemistry	5 credits/100
	CHEM- 603	Literature review, Report writing and Presentation	5 Credits/100

Assessment of the course work will be made on grading system. The grading pattern will be as follows:

Marks	Grade	Remark
81-90	O	Excellent
71-80	A	Very Good
61-70	B	Good
51-60	C	Fair
40-50	D	Poor

For qualifying the course one has to secure minimum C grade.

RESEARCH METHODOLOGY AND RESEARCH ETHICS

INTRODUCTION TO SCIENTIFIC RESEARCH

1. Nature and definition of research; Aims and Objectives of research
2. Types of research
3. Steps in Scientific research
4. Hypotheses – types, sources and uses
5. Selection of Research problem; Research design – meaning, purpose; Characteristics of a good research design; Designs for different types of research – qualitative research, quantitative research, evaluation research, action research.

DATA COLLECTION, ANALYSIS AND REPORTING

1. Techniques of Data Collection
2. Observation – types; Process of observation; Problems in Observation; Advantages and limitations; Observation schedule
3. Data Processing and Analysis
4. Data processing – editing, coding; Tabulation of Data, Diagrammatic representation of data
5. Report Writing
6. Basic components of a research report

PHILOSOPHY AND ETHICS

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

SCIENTIFIC CONDUCT

1. Ethics with respect to science and research
2. Intellectual honesty and research integrity
3. Scientific misconducts: Falsification, Fabrication, and Plagiarism
4. Redundant publications: duplicate and overlapping publications, salami slicing
5. Selective reporting and misrepresentation of data.

PUBLICATION ETHICS

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 behaviour 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

OPEN ACCESS PUBLISHING

1. Open access publications and initiatives
2. SHERPA/ RoMEO online resource to check publisher copyright and 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.

PUBLICATION MISCONDUCT

A. Group Discussions

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

1. Use of plagiarism software like Turnitin, Urkund and other open source software tools

DATABASES AND RESEARCH METRICS

A. Databases

1. Indexing databases
2. Citation databases: Web of Science, Scopus, etc.

B. Research Metrics

1. Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score
2. Metrics: h-index, g-index, i10 index, altmetrics

Reference Books:

1. Gopal Lal Jain; *Research Methodology, Methods, Tools and Techniques*; 2nd Ed., 2003, Mangal Deep Publications, Jaipur.
2. Michael Quinn Patton, *Qualitative Research & Evaluation Methods*, 3rd Ed., 2002, Sage Publications, Inc.
3. S.C. Sinha and A.K. Dhiman, *Research Methodology*, 2002, Ess Ess Publications, New Delhi.
4. S.L. Jat, N.P. Agarwal, M.S. Poonia, *Research Methodology*, 2007, Indus Valley Publications, Jaipur.
5. V.K. Jain, *Basic Programming with Applications*, Tata McGraw Hill, 1995.
6. Bird, A. (2006). *Philosophy of Science*, Routledge.
7. MacIntyre, Alasdair (1967) *A Short History of Ethics*. London.
8. P. Chaddah, (2018), *Ethics in Competitive Research: Do not get scooped; do not get plagiarized*.
9. National Academy of Sciences, National Academy of Engineering and Institute of Medicine. (2009). *On being a Scientist: A Guide to Responsible Conduct in Research*, 3rd Edition. National Academies Press.
10. Indian National Science Academy (INSA), *Ethics in Science Education, Research and Governance* (2019).

ANALYTICAL AND SPECTROSCOPIC TECHNIQUES IN CHEMISTRY

Mass Spectroscopy

Mass spectral fragmentation of organic compounds, common functional groups; molecular ion peak, McLafferty rearrangement, examples of mass spectral fragmentation of organic compounds with respect to their structure determination. Principles of electron-impact induced mass spectrometry and FAB, metastable ions and transitions, Stevenson's rules.

Advance NMR Techniques (Basic knowledge)

Two dimension NMR spectroscopy; NOISY, DEPT, INEPT terminology.

Mossbauer Spectroscopy

The Mossbauer Effect, the Mossbauer Nuclei, the spectral line width, the chemical isomer shift, the quadruple splitting, magnetic hyperfine interaction, measurement techniques, elucidation of electronic structure of ^{57}Fe , ^{119}Sn and ^{151}Eu complexes using Mossbauer

Absorption and Emission spectroscopy

Atomic Absorption spectroscopy, atomic emission spectroscopy, Instrumentation and application.

Microwave and Rotational Spectroscopy

Concept and applications

Thermal analysis

Understanding of TGA, DTA, DSC and its applications

Other Techniques

Introduction to SEM, TEM and XRD,

Recommended Books:

1. Instrumental Methods of Analysis, H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, CBS Publications.
2. Principles of Instrumental Analysis, D.A. Skoog, W. B. Saunders.
3. Thermal Methods of Analysis, W.W. Wendlandt., Wiley Inter-Science.
4. Analytical Chemistry, D. Kealey, P.J. Haines, Viva Books Private Limited,
5. Basic Concepts of Analytical Chemistry, S.M. Khopkar
6. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J. Thomas, Pearson Education.
7. R. M. Silverstein, G. C. Basseler & T. C. Morill. *Spectroscopic Identification of Organic Compounds*, John Wiley.
8. Jag Mohan, *Organic Spectroscopy: Principles and Applications*, Narosa Publishing House, New Delhi.
9. W. Kemp. *Organic Spectroscopy*, McMillan Press Ltd.