## CH-833 Scientific Writing & Research Methods

**Credit Hours** 3-0

**Prerequisites** Nil

**Course Objectives**

This course aims to equip students with an advanced understanding of scientific research methodologies, including the formulation of hypotheses, development of research questions, and application of the scientific method. It trains students to critically evaluate scientific literature, identify research gaps, and design proposals aligned with contemporary challenges. Emphasis is placed on research ethics, including data integrity, plagiarism, and publication ethics, alongside the use of modern tools for data visualization, reference management, and reproducibility in line with FAIR principles. Students will also develop essential scientific writing and communication skills, enabling them to prepare high-quality theses, journal articles, and grant proposals, as well as effectively present their research through conferences and academic platforms. The course further encourages students to build a strong academic profile and explore research and career opportunities in academia and industry.

**Course Contents:**

Introduction to research: definition, types, and purpose. Advanced scientific methods: observation, hypothesis, experimentation, data analysis, conclusion, reporting. Hypotheses: types, formulation, and role in research design. Formulating precise research questions and objectives with current scientific challenges. Ethics: data integrity, plagiarism, fabrication. Scientific articles and literature surveys: article types, databases, identifying research gaps, building theoretical frameworks. Reading and evaluating scientific articles with hands-on exercise. Proposal writing: targeting funding agencies, budget estimation. Mock Grant proposal writing, budgeting, and project management. References: management software, citation styles. Data visualization and analysis: interpretation tools, advanced graph making. Advanced tools for chemistry research and analysis. FAIR data principles: sharing and reproducibility. Thesis and report writing structure, timeline management. Writing for high-impact journals: Research and Review articles, structure, and

critical evaluation. Plagiarism detection, tools, and publishing ethics. Conflict of interest. Image creation for publication: copyright, permissions. Submission and peer review: cover and rebuttal letters, galley proofs, editorial queries, copyright transfer, open access vs. subscription, preprints, and publication ethics. Academic profiles: ORCID, Scopus, ResearchGate, Researcher ID, LinkedIn. Science communication: conference abstracts, proceedings, presentations, poster design. Professional communication: effective emails, etiquette. Research opportunities: fellowships, postdocs, industry research and development (R&D).

**Course Outcomes:**

By the end of this course, the students will be able to:

1. Develop research proposals and scientific reports, adhering to the ethical standards and academic conventions.
2. Critically evaluate scientific literature to identify research gaps and formulate hypotheses.
3. Apply advanced research methodologies and data analysis techniques in chemical studies.
4. Utilize referencing tools and citation methods to ensure academic integrity.

**RECOMMENDED BOOKS**


1. Tyowua, A. T. (2023). *A Practical Guide to Scientific Writing in Chemistry: Scientific Papers, Research Grants and Book Proposals* (1st ed.). CRC Press. ISBN: 9781003186748.
2. Thomas, C. G. (2021). *Research Methodology and Scientific Writing* (2nd ed.). Springer. ISBN: 978-3-030-64865-7.
3. Stewart Jr, C. N. (2023). *Research Ethics for Scientists: A Companion for Students* (2nd ed.). John Wiley & Sons. ISBN: 9781119837886.
4. Creswell, J. W., & Creswell, J. D. (2022). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (6th ed.). Sage Publications. ISBN: 9781071817964.
5. Coghill, A. M., & Garson, L. R. (Eds.). (2006). *The ACS Style Guide: Effective Communication of Scientific Information* (3rd ed.). American Chemical Society. ISBN: 9780841239999.

6. Bailey, S. (2014). *Academic Writing: A Handbook for International Students* (4th ed.). Routledge. ISBN: 9781315768960.
7. Schimel, J. (2012). *Writing Science: How to Write Papers That Get Cited and Proposals That Get Funded* (1st ed.). Oxford University Press USA. ISBN: 9780199760244.
8. Pollock, T. G. (2025). *How to Use Storytelling in Your Academic Writing: Techniques for Engaging Readers and Successfully Navigating the Writing and Publishing Processes* (2nd ed.). Edward Elgar Publishing. ISBN: 9781035325900.
9. Bailey, S. (2024). *The Essentials of Academic Writing for International Students* (2nd ed.). Routledge. ISBN: 9781032721729.
10. Cartwright, H. M. (Ed.). (2020). *Machine Learning in Chemistry* (1st ed., No. 17). Royal Society of Chemistry. ISBN: 978-1-83916-024-0.
11. Janet, J. P., & Kulik, H. J. (2020). *Machine Learning in Chemistry* (Vol. 1). American Chemical Society. ISBN: 9780841299009.
12. Akitsu, T. (Ed.). (2021). *Computational and Data-Driven Chemistry Using Artificial Intelligence: Fundamentals, Methods and Applications* (1st ed.). Elsevier. ISBN: 978-0-12-822249-2.

Hibbert, D. B., & Gooding, J. J. (2006). *Data Analysis for Chemistry: An Introductory Guide for Students and Laboratory Scientists*. Oxford University Press (OUP) USA. ISBN: 9780195162110.