DEPARTMENT OF CHEMISTRY

School of Physical Sciences

Central University of Kerala

Tejaswini Hills, Periye P.O.

Kasaragod 671320, Kerala

PhD Chemistry Syllabus - 2021

Programme outcome

- Doctoral Research in the Department of Chemistry at Central University of Kerala aims to equip scholars to take–up challenging tasks for the future that ultimately benefits the society

Specific outcome

The programme enables the students to

- Design and conduct original research in their area of specialization
- Attain systematic understanding of a subject and mastery of the skills and methods associated with the subject
- Develop skills for critical analysis, assessment and synthesis of new and complex ideas
- Develop further the progress made in technological, social or cultural terms within an academic and professional context
- Demonstrate the ability to communicate the results of their research in a clear and effective manner
- Demonstrate an understanding and concern for the high ethical standards in research, teaching, and service
- Demonstrate the ability to teach college-level courses in their area of specialization

Participatory learning

- Many workshops, seminars, and conferences are conducted to motivate the PhD scholars to present their work and also to acquire and update knowledge on cutting edge research activities across the globe.

PhD Chemistry Course Structure

Title of the Course	Credit value	Marks		Total
		Continuous Evaluation	End-Semester Evaluation	
Course 1. Research methodology (including quantitative methods and computer application, where relevant)	4	40	60	100
Course 2. Research and Publication Ethics (mandatory as per UGC circular 2019)	2	40	60	100
Course 3. Special Course related to the core area of research	6	40	60	100
Course 4. Course on the specific research proposal including a review of literature	6	------	100	100

PhD Chemistry

Structure of the common courses

Course Code	Course Title	Contact hrs./wk				Credits
		Lect.	Lab	Tutorial	Total	
CHE 701	**Research Methodology**	**4**	**-**	**2**	**6**	**4**
CHE 709	**Research and Publication Ethics**	**4**	**-**	**2**	**6**	**2**

Syllabus in Detail:

CHE-701 Research Methodology

1. Research Methodology and Data analysis

   Research processes - scientific research formation of the topic, hypothesis, conceptual definitions, operational definition, gathering of data, analysis of data, revising of hypothesis, Conclusion. Literature survey - Journals, books and e-resources. Presentation and publication of research output. Errors in chemical analysis, classification of errors, determination of accuracy of methods, improving accuracy of analysis, significant figures, mean, standard deviation, comparison of results: “t” test, “f” test and “chi” square test, least squares analysis, weighted least squares analysis, regression coefficient, rejection of results, presentation of data.

2. Basic Methods in Chemical Analysis

   Fundamental and over view of FT-IR spectroscopy, CHN analyser, Chromatography (TLC, GC & HPLC), UV-Visible spectroscopy, Fluorescence, Thermal analysis (DSC & TGA), Atomic

absorption spectroscopy, X-ray diffraction analysis, Nuclear Magnetic Resonance (NMR) spectroscopy and Mass Spectrometry, computational tools in chemistry.

3. Chemistry Pedagogy

   The student shall involve in a Teaching Assistant (TA) or Tutor for any chemistry course preferably for laboratory courses. The course instructor will closely monitor the work of the Ph. D. student, provide mentoring, finally evaluate him for his pedagogic skills and knowledge of the subject and award a grade.

4. Computer Knowledge in Research

   Operating System-Windows and Linux. Document Preparation-Microsoft Word and LaTex. Web browsing: Various publishers such as ACS, RSC, Wiley, Science Direct, Scopus, Web of Science, UGC-INFLIBNET, Shodh Sindu, Shodh Ganga and Plagiarism software. Chemistry related software: SciFinder, Reaxys, ChemDraw, ISIS Draw etc.

   Analysis/Plotting Software: EXCEL, ORIGIN, MATLAB, etc. Presentation Tools: Power Point Presentation and LaTex

References

1. C. R. Kothari, Research Methodology Methods and Techniques, 2nd Revised Ed., 1990.
2. Robert V Smith, Graduate Research: A Guide for Students in the Sciences, University of Washington Press, 1998.
3. Willard, H. H., Merritt, L. L., Dean, J. A. & Settle, F. A. (Eds.) *Instrumental Methods of Analysis* - 7th Ed., Wadsworth Publishing (1988) ISBN 0534081428
4. Skoog, D. A., West, D. M., Holler, R. J & Nieman, T. A. *Principles of Instrumental Analysis* Saunders Golden Sunburst Series (1997).
5. Paul D Leedy, Jeanne E Ormrod and Jeanne Ellis Ormrod, Practical Research: Planning and Design, Prentice Hall, 2004.

Course Outcome:

By completing this course, students will obtain the following course/learning outcomes:

- Understand philosophy of doctoral research; ethics in research and scientific publishing
- Collect literature and data/materials for specific research problem
- Learn the basic and sophisticated characterization methods required for research
- Learn basic computational tools useful for chemical research
- Learn to use softwares and programs necessary for data analysis, presentation of results and preparation of research reports and scientific publications
- Present and defend results to an audience in a clear manner

CHE 709 Research and Publication Ethics

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.

Course structure

• 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 behaviour and vice versa, types
5. Violation of publication ethics, authorship and contributor ship
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

1. Bird, A. (2006). *Philosophy of Science.* Routledge.
2. MacIntyre, Alasdair (1967*) A Short History of Ethics*. London. P.

3. 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. Resnik, D. B. (2011). What is ethics in research & why is it important. *National Institute of Environmental Health Science*s, 1-10. Retrieved from https://www.niehs.nih.gov/research/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
7. 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

Course Outcome:

By completing this course, students will obtain the following course/learning outcomes:

- Understand ethics and philosophy of doctoral research
- Learn the importance of integrity, honesty, and good research practice in research work
- Understand scientific and publishing misconduct and take measures to avoid it
- Become aware of the importance of ethics in scientific publishing
- Learn to utilize the databases and resources efficiently for research pupose
- Aware of the responsibility for research, results and consequences of research