



MEDI-CAPS
UNIVERSITY



मेडी-केप्स विश्वविद्यालय, इंदौर

Medi-Caps University, Indore

Syllabus

Ph.D. CHEMISTRY SCHEME AND SYLLABUS



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CURRICULUM AND SYLLABUS (2024-2025) Ph.D. CHEMISTRY

Vision of the University:

Be an internationally acclaimed University recognised for its excellent teaching, research, innovation, outreach and creating top class technocrats and professionals who can serve the mankind as multi skilled global citizen.

Mission of the University:

- Establish state-of-the-art facilities for world class education and research.
- Conduct scholarly research and creative endeavours that impact quality of life.
- Attract quality staff and students to cater for diverse needs and preferences and widen participation.
- Build a foundation for students to be successful at all levels through high-quality, innovative programs.
- Collaborate with institute, industry, and society to address current issues through research and align curriculum.
- Involve in societal outreach programs to identify concerns and provide sustainable ethical solutions.

Vision of the Department:

To achieve excellence in educational and research in the field of chemistry and to generated high class professionals to cater the ever-changing industrial demands and social needs.

Mission of the Department:

1. Attracting experienced faculty members and expert research professionals for creating an outstanding academic environment.
2. Maintaining state of the art research facilities to provide collaborative environment that stimulates faculty, staff and students with opportunities to create, analyse, apply and disseminate knowledge.
3. Providing globally competitive education to students in order to enhance their skills to



meet the future challenges.

4. Providing excellent academic environment to students for inculcating practical approach for lifelong learning and bright career.



Department of Chemistry

Program Education Objectives (PEOs)

PEO₀₁: To develop professionals who utilize fundamental knowledge, analytical and problem-solving skills to articulate and make decisions critically and creatively based on research evidence and experiences in professional practice.

PEO₀₂: To develop professionals who competently provide solutions for the advancement of knowledge through the application of appropriate tools and techniques.

PEO₀₃: To develop professionals who continue to acquire advanced knowledge in pursuing lifelong learning and display commitment to the community and profession through effective communication with peers by adhering to legal, ethical and professional codes of practice.



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Department of Chemistry

PROGRAMME OUTCOMES (POs)

After
the
students
to:

completion of
Program, the
shall be able

PO ₀₁	Have a strong foundation in the fundamentals of basic as well as current scientific theories and their applications in real life.
PO ₀₂	Equip with the skills to analyze problems, formulate a hypothesis, evaluate and validate results, and draw reasonable conclusions.
PO ₀₃	Articulate ideas and strategies for addressing a research problem.
PO ₀₄	Have proficiency in analytical reasoning, critical thinking and problem solving, as applied to scientific problems.
PO ₀₅	Effectively communicate research, through journal publications and conference presentations, to the community.
PO ₀₆	Have skills to explore new areas of research in fields of science and technology.
PO ₀₇	Have an ability to adopt ethical practices in developing scientific solutions for the key issues being faced by our society.
PO ₀₈	Develop an ability to identify unsolved yet relevant problem in a specific field.
PO ₀₉	Participate as a member of interdisciplinary problem-solving team.
PO ₁₀	Have an ability of developing innovative and cost-effective techniques and products.
PO ₁₁	Commit to the professionals, legal and social responsibilities of a researcher.
PO ₁₂	Develop an ability to engage in life-long learning by adapting knowledge of contemporary issues.



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Department of Chemistry

After completion of the Program of Ph.D. Chemistry, students shall be able to:

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO₀₁	Have advanced specific knowledge in the chosen frontier area in chemical sciences
PSO₀₂	Have an understanding to handle and develop new methods for specific problem.
PSO₀₃	Have an understanding to conduct and disseminate research professionally, responsibly, and safely, in accord with the ethical standards and best practices of the profession.
PSO₀₄	Have an opportunity to expert in a specific area and to become competent as an independent researcher.



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Medi-Caps University Indore (M.P.)
Department of Chemistry
Choice Based Credit System- Scheme of Ph.D. Chemistry- Course Work
(2024 Batch)

Code	Course	Core/Elective	Teaching Hours		Theory		Total	Credit
			Th	Pr	Sess	End Sem		
MU6RD01	Research and Publication Ethics	Research and Development (RD)	2	0	40	60	100	2
MU6RD03	Review of Published Research	Research and Development (RD)	0	4	-	-	100 (TI)	2
SC6RD01	Research Methodology	Research and Development (RD)	4	0	40	60	100	4
CH6CW02	Chemistry of Materials	Course Work (CW)	4	0	40	60	100	4
Total			10	4	120	180	400	12



Syllabus :

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
MU6RD01	Research and Publication Ethics	2	0	0	2

Unit-I

Philosophy, Ethics and Paradigm of Research: Introduction to Philosophy: definition, nature and scope, concept, branches. Ethics: definition, moral Philosophy, nature of moral judgments and reactions. Philosophy of scientific research, research paradigm, approaches and components of research paradigm, artifacts, values and beliefs.

Unit-II

Scientific Conduct: Ethics with respect to science and research, Ethics in Measurement Practices , Ethics aspects of Funding policies, Intellectual property rights, Intellectual honesty and research integrity, Scientific misconducts: Whistle blowing, Falsification, Fabrication and Plagiarism(FFP), Image manipulation, violation of copy right act. Redundant publication: duplicate and overlapping publications, salami slicing. Selective reporting and misrepresentation of data .

Unit-III

Publication Ethics: Definition, introduction and importance, responsibilities of authors, Best practices/standards setting initiatives and guidelines: COPE, WAME, etc. Conflicts of interest, privacy and confidentiality. Publication misconducts: definition, concepts, problems that lead to unethical behavior and vice versa, types. Editorial and review ethics , Violation of publication ethics, authorship and contributor-ship, Withdrawal of articles, Data protection legislation. Identification of publication misconduct, complaints and appeals. Predatory publishers and journals.

Unit-IV

Open Access Publishing: Open access publications and initiatives. SHERPA/RoMEO online resource to check publisher copyright and self-archiving policies. Software tools to identify predatory publications developed by SPPU. Journal finder/Journal suggestion tool viz. JANE, Elsevier finder, Springer journal suggester, etc.

Unit-V

Database and Research Metrics:

Database: Indexing database. Citation database: 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.

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

Group Discussions and Case Study: Subject specific ethical issues, FFP, Authorship. Conflicts of interest. Complaints and appeals: examples and fraud from India and abroad.

Text Book :

1. Chaddah Praveen (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarized, ISBN: 978-9387480865.
2. Day RA (1979) How to write and publish a scientific paper. ISI press, Philadelphia.
3. Committee on Publication Ethics (COPE): Guidelines on good publication practice (<https://publicationethics.org/resources/guidelines>)
4. Moore A (2013) What's in a peer review report?. Bio Essays.

Reference Book:

1. The Ethics of Teaching and Scientific Research By Miro Todorovich; Paul Kurtz; Sidney Hook.
2. Research Ethics: A Psychological Approach By Barbara H. Stanley; Joan E. Sieber; Gary B. Melton.
3. Research Methods in Applied Settings: An Integrated Approach to Design and Analysis By Jeffrey A. Gliner; George A. Morgan Lawrence Erlbaum Associates, 2000.
4. Ethics and Values in Industrial-Organizational Psychology By Joel Lefkowitz Lawrence Erlbaum Associates, 2003.
5. Bird, A. (2006). *Philosophy of Science*. Routledge.
6. Mac Intyre, Alasdair (1967) *A short History of Ethics*. London.
7. 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.
8. Resnik, D. B. (2011), What is ethics in research & why is it important. *National Institute of Environmental Health Sciences*, 1-10. Retrieved from <http://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm>.
9. Beall, J. (2012), Predatory publishers are corrupting open access. *Nature*, 489 (7415), 179-179. <http://doi.org/10.1038/489179a>.



10. Indian National Science Academy (INSA), Ethics in Science Education, Research Governance (2019), ISBN: 978-81-939482-1-7.
http://www.insaindia.res.in/pdf/Ethics_Book.pdf.



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Faculty of Science - Ph. D. Research Methodology
Syllabus - Scheme: 400

Unit I Introduction to Research Methodology

Definition and objective of research, types of research, significance of research, Experimental, Theoretical and Computational research. Literature collection, understanding online resources, Overview, importance of reviews, monographs, patent, research databases, surveys and books for fundamental understanding.

Unit II Research formulation and Design

Conceptualization and formulation of research problem, importance of literature review, evaluation of research and formulation of hypothesis. Understanding data bases, Identification of gap areas, need for verifications and experiments.

Unit III Data collection and interpretation

Data sources, data collation techniques, validity and reliability of data, data plots, statistical methods for interpretation, simulation techniques, concept of error analysis, error bars and standard deviation,

Unit IV Computational techniques and tools

Fundamentals tools, programming skills, scientific software, web searching tools, analytical techniques, statistical techniques, data analysis, Types of Errors, systematic and random errors, interpretation, presentation tools. Understanding plagiarism check software.

Unit V Technical /Scientific writing and Research presentation

Structure and components of research project, types of reports, layout of research report, synopsis, dissertation, thesis, scientific articles and reviews, importance of bibliography and citation. Presentation of project proposal, presentation of project report, poster and oral presentation of research paper, Presentation and delivering of plenary lecture, virtual/tele and online presentation.

Text Books:

- ❖ Kothari C.K., Research Methodology – methods and techniques. New Age International, New Delhi, 2004.
- ❖ Peter Pruzan, Research Methodology: The Aims, Practices and Ethics of science. Springer, 2016.
- ❖ D.G. Montgomery, Design and analysis of experiments, John Willy India Edition.

Reference Books:

- ❖ Michael P. Marder, Research methods for science. Cambridge University press, 2011.
- ❖ Hilary Glasman-Deal, Science Research writing for non-native speakers of English. World scientific, 2010.

Signature V. Gaur



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Syllabus

Course Code	Course Name	Hours per Week			Total Credits
		L	T	P	
CH16CW02	Chemistry of Materials	4	0	0	4

Unit-I Green chemistry and synthesis

Green Chemistry and its 12 principles, Waste prevention and minimization of waste generation, Nature of Chemicals, Atom economy, less hazardous chemical synthesis, designing safer chemicals, Future trends in Green Chemistry - Green catalysts, Green nano-synthesis, Biomass conversion, emission control.

Unit -II Drug designing

Development of new drugs, procedure followed in drug design, Concept of pro-drugs and soft drugs. Structure and activity relationship between chemical structure and biological activity (SAR). Factors affecting bioactivity, Quantitative structure activity relationship (QSAR). Concepts of drug receptors, LD-50, ED-50.

Unit -III Synthesis and applications of nanomaterials

Definition, Types of nanostructures, Properties and Applications: application as ferroelectric materials, coating, molecular electronics and nanoelectronics, biological and environmental, membrane based application, polymer based application, nano-catalysis.

Synthesis and preparation of Nanomaterials-mechanical methods, methods based on evaporation, Sputter and deposition, Chemical vapour deposition, Electric arc deposition, sol- gel method, synthesis by using plant extract.

Unit -IV Instrumental Techniques in Chemical Analysis

UV-VIS Spectroscopy, IR-Spectroscopy, NMR Spectroscopy, GC-Mass Spectroscopy, XRD Techniques. Principle of chromatography, Classifications of chromatography, Techniques of planar and column chromatography, Gas chromatography, High-performance liquid chromatography.

Unit V Computational chemistry

Introduction of Computational Chemistry, Tools of Computational Chemistry, Density Functional Theory, Selected advanced level scientific software packages after a brief introduction to the basic theory and methodology. Ab initio quantum chemical packages such as Gaussian/GAMESS (General Atomic and Molecular Electronic Structure System)/ Argus Lab, Chem Sketch, Chem craft, etc.

Soni

10/10/2021

XRB

Text Books:

1. Green Chemistry: Theory and Practice, Anastas P.T. and Warner J.C.; Oxford University Press, 1998
2. Green Chemistry, V.K. Ahluwalia, Narosa Publishing House Pvt. Ltd., 2013
3. An Introduction to Green Chemistry Mathack A.S., Marcel Dekker, 2001
4. Computational Chemistry by A. C. Norris, John Wiley
5. Synthesis of nanomaterial – Sulabha Kulkarni, Capital Pub, 2011
6. Chemistry of nanomaterials: Synthesis, properties and applications - CNR Rao et.al.
7. Instrumental Methods of Chemical Analysis, G.A. Chatwal and S.K. Anand, Himalaya Publishing House 5th edition, 2019
8. Principles of Medicinal Chemistry, 3rd Edition (1989), W. O. Foye, Lea & Febiger/ Varghese Publishing House, Bombay.
9. Medicinal Chemistry, A. Kar, (1993) Wiley Eastern Ltd., New Delhi.
10. Strategies for organic drug synthesis and design (2009), Daniel Lednicer, John Wiley & Sons, New York.

Doni

Pravir
5/10/2021
(Dean Science)

Shilpa