



**Ph.D. PROGRAMME (FULL-TIME) IN CHEMISTRY
DEPARTMENT OF CHEMISTRY
ST. JOSEPH'S COLLEGE (Autonomous)
Tiruchirappalli-620 002
PAPER – I
COURSE CODE CH101
CREDIT:4
RESEARCH METHODOLOGY**

Unit – I: Introduction to Methods of Research

Motivation and objectives – Research methods versus methodology. Types of research – descriptive versus analytical, applied versus fundamental, quantitative versus qualitative, conceptual versus empirical.

Unit - II: Research Formulation

Literature review – Primary and secondary sources – reviews, treatises, monographs – patents – web as a source – searching the web - Critical literature review – Identifying gap areas from literature review - Development of working hypothesis – Research Proposal and its elements – Formulation of research problem.

Unit III: Report writing

Structure and components of scientific reports - Types of report – Technical reports and thesis – Significance – Different steps in the preparation – Layout, structure and Language of typical reports – Illustrations and tables – Reference section of report

Unit – IV: Information Retrieval and Documentation

Sources of information – primary, secondary, tertiary sources – journals – abstracts – current titles – reviews – monographs – information retrieval using internet and other electronic media (preparing a review article related to the problem of research of the student). Reports of research work – laboratory observation – preparation of records – manuscripts – research paper formats in Indian Journal of Chemistry, Journal of Indian Chemical Society, Journal of American Chemical Society, Royal Society of Chemistry and Elsevier-Chemistry Journals

Unit – V: Statistical Tools of Research

Error analysis – errors – types – precision and accuracy – significant figures – tests for accuracy of results – positive and negative deviations from accuracy – distributions – Binomial – Gaussian. Normal distribution of random errors – mean, variance, standard deviation, confidence interval – F , t , and Q tests – regression analysis – linear regression – Hypothesis generation and testing – evolving and modifying rules and theories.

References

1. Garg B L, Karadia R, Agarwal F and Agarwal, *An introduction to Research Methodology*, RBSA Publishers, U.K., (2002).
2. Kothari C R, *Research Methodology: Methods and Techniques*, New Age International, (1990).
3. Margrat Levine Young, *Internet: The Complete Reference*, McGraw-Hill, Osborne (1999).
4. Jeffery G H et al., *Vogel's Text Book of quantitative chemical analysis*, Fifth Edition, Longmann Scientific and Technical, Essex, England (1989).
5. Harvey D, *Modern Analytical Chemistry*, McGraw Hill, New York (2000).
6. Harris D C, *Quantitative Chemical Analysis*, Eighth Edition, W H Freeman and Company, New York (2010).

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PAPER- II
COURSE CODE: CH102
CREDIT:2

RESEARCH AND PUBLICATION ETHICS

Unit-I: Philosophy and Ethics

Introduction to philosophy: definition, nature and scope, concept, branches- Ethics: definition, moral philosophy, nature of moral judgements and reactions- Ethics with respect to science and research - Intellectual honesty and research integrity - Scientific misconducts: Falsification, Fabrication and Plagiarism – Redundant publications: duplicate and overlapping publications – Selective reporting and misrepresentation of data

Unit-II: Publication Ethics

Publication ethics – definition-introduction and importance – Best practices – Conflicts of interest – Publication misconduct-definition-concept-problems that lead to unethical behavior – Violation of publication ethics, authorship and contributorship – Identification of publication misconduct-complaints and appeals

Unit-III: Open Access Publishing

Open access publications and initiatives – SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies – Software tool to identify predatory publications developed by SPPU – Journal finder – Elsevier & Springer

Unit-IV: Publication Misconduct

Group discussions-Subject specific ethical issues, authorship – Complaints and appeals-examples and fraud from India and abroad – Software tools-Use of plagiarism software like Turnitin, Urkund and other open source software tools

Unit-V: Databases and Research Metrics

Databases-Indexing databases-Citation databases-Web of Science & Scopus – Research Metrics-Impact factor of journal as per Journal Citation Report-Cite Score – Metrics-h index-g index, i10 index, altmetrics


References

1. Bird A, *Philosophy of Science*, Routledge (2006).
2. MacIntyre and Alasdair, *A Short History of Ethics*, London (1967).
3. Chaddah, P, *Ethics in Competitive Research: Do not get scooped; do not get plagiarized*, ISBN:978-9387480865 (2018).


4. National Academy of Sciences, National Academy of Engineering and Institute of Medicine, *On Being a Scientist: A Guide to Responsible Conduct in Research*, Third Edition, National Academies Press (2009).
5. Indian National Science Academy, *Ethics in Science Education*, Research and Governance (2019).

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PAPER- III
COURSE CODE: CH103
CREDIT:4
HETEROCYCLES AND THEIR SYNTHETIC METHODS

Unit I: Introduction

Definition of heteroatom – examples of heterocycles and their structures (alkaloids, purine and pyrimidine bases) — Nomenclature of four, five and six membered nitrogen heterocycles – Aromaticity of heterocycles

Unit II: Synthesis of heterocycles

Paal-Knorr Synthesis of pyrrole, furan and thiophene – Fischer indole synthesis – Hantzsch pyridine synthesis – Skraup quinoline synthesis – Pomeranz-Fritsch isoquinoline synthesis – Hofmann-Löffler-Freytag pyrrolidine synthesis – Von Richter Cinnoline synthesis

Unit III: Properties of heterocycles I

Physical properties and structures of 5-membered heterocycles (pyrrole, furan, thiophene and indole), 6-membered heterocycles (pyridine, quinoline and isoquinoline), diazines (pyrazine and Pyrimidine), azines (oxazine and azepine) – Acidity and basicity of heterocycles (pyrrole, furan, thiophene, pyridine, indole, piperidine and pyrrolidine)

Unit IV: Properties of heterocycles-2


Oxidation and reductions in heterocyclic chemistry - Electrophilic and nucleophilic substitutions in pyrrole, thiophene, furan, pyridine, quinoline and isoquinoline


Unit V: Heterocycles in medicine

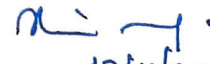
Structure-synthesis-medicinal uses of chromone, flavanones, flavones, flavonols, isoflavones, anthocyanins, purines, pyrimidines, uric acid, penicillins and sulpha drugs

References:

1. Final I L, *Organic Chemistry* Volume I and II, Sixth Edition, ELBS with Longmann, Singapore (1997).
2. Clayden, Greaver, Warren and Wothers, *Organic Chemistry*, Oxford University Press, New York (2006).
3. Bansal and Raj K, *Heterocyclic Chemistry*, Fifth Edition, New Age International Publishers, New Delhi (2010).

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