AUXILIUM COLLEGE (AUTONOMOUS)

VELLORE

M.Sc. CHEMISTRY

Curriculum Development – Professional Ethics

SEMESTER III

PICHG20 - IEP - RESEARCH METHODOLOGY

Year: II **SEM:** III	**Course Code** PICHG20	**Title of the Course** Research Methodology	**Course Type** Theory	**Course Category** Independent Elective	**H/W** Own Pace	**Credits** 2	**Marks** 100

Learning Objectives:

- To introduce the purpose and importance of research.
- To gain information about the various sources of literature.
- To learn the scientific method of collecting data and to compute statistical parameters to arrive at meaningful conclusions.
- To emphasize the importance of ethics in research and chemical safety.

Course Outcomes:

The Learners will be able to

1. Define research and its objectives, illustrate hypothesis testing, and draw the research plan.
2. Carry out literature search offline and online to fix the research problem and illustrate the importance of IF, SCI, h index and i-index.
3. Apply statistical analysis in research methodology.
4. Describe the general format of thesis writing and the research ethics to be followed.
5. Illustrate the safety measures to be taken in handling toxic, inflammable and explosive chemicals.

CO	**PSO**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

CO	**PO**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H

CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

H-High (3), M-Moderate (2), L-Low (1)

Unit I

1.1 Scope of research - research methodology - definition of research, purpose of research. (K1, K2 & K3)

1.2 Types of research - descriptive vs analytical, applied vs fundamental, quantitative vs qualitative, conceptual vs empirical and other types of research. (K1, K2 & K3)

1.3 Research design - planning of research, selection of a problem for research. (K1, K2, K3 & K4)

1.4 Research process - steps involved. (K1, K2 & K3)

1.5 Problems and hypothesis in research - identification of problems, sources, factors influencing selection of problems. (K1, K2, K3 & K4)

1.6 Development and testing of hypothesis. (K1, K2, K3 & K4)

Unit II

2.1 Literature search techniques - sources of information, need for reviewing literature. (K1, K2 & K3)

2.2 Primary, secondary and tertiary sources - journals, E-journals, journal access, journal abbreviations, chemical abstracts, Beilstein, reviews, monographs, dictionaries, text books. (K1, K2 & K3)

2.3 UGC infonet, E-resources. (K1, K2, K3 & K4)

2.4 Search engines - Google scholar, chemical industry, Wiki-databases, chemSpider, Science Direct, SciFinder, Scopus, SPN, Reaxys, orbit.com, Thompson innovations. (K1, K2, K3 & K4)

2.5 Indices - subject index, substance index, author index, formula index and other indices with examples, searches through structure, knowledge of national and international journals. (K1, K2, K3 & K4)

2.6 Impact Factor, Citation-Index, h Index, I-index, SCI Journals. (K1, K2, K3 & K4)

Unit III

3.1 Data Analysis - errors in chemical analysis, types of errors, precision and accuracy. (K1, K2, K3 & K4)

3.2 Significant figures, measures of central tendency - arithmetic mean, median, mode. (K1, K2, K3 & K4)

3.3 Methods of dispersion - standard deviation, co-efficient of variation (discrete series and continuous series). (K1, K2, K3 & K4)

3.4 Comparison of results - t- test, F- test and chi square test. (K1, K2, K3 & K4)

3.5 Correlation - coefficient of correlation, linear regression - coefficient of regression. (K1, K2, K3 & K4)

3.6 Multiple linear regression. (K1, K2, K3 & K4)

Unit IV

4.1 Writing a thesis: The general format - page and chapter format - the use of quotations - footnotes and figures - referencing - appendices - references. (K1, K2 & K3)

4.2 Research Ethics - academic honesty, intellectual ownership - copy right, royalty. (K1, K2 & K3)

4.3 Intellectual property rights and patent law. (K1, K2 & K3)

4.4 Plagiarism - responsibility, reproduction of published material and accountability of the researcher, situation that raises ethical issues, freedom and privacy from coercion. (K1, K2 & K3)

4.5 Ethics in relation to other people, role of research participant. (K1, K2 & K3)

4.6 Software for detecting plagiarism. (K1, K2 & K3)

Unit V

5.1 Concepts of chemical safety: Chemical safety and ethical handling of chemicals. (K1, K2, K3 & K4)

5.2 Safe working procedure and protective environment. (K1, K2, K3 & K4)

5.3 Emergency procedure and first aid, laboratory ventilation, safe storage and handling of hazardous chemical. (K1, K2, K3 & K4)

5.4 Procedure for working with substances that pose hazards, flammable or explosive hazards. (K1, K2, K3 & K4)

5.5 Procedures for working with gases at pressures above or below atmosphere. (K1, K2, K3 & K4)

5.6 Safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals. (K1, K2, K3 & K4)

Reference Books:

1. Anderson, Thesis and Assignment Writing, Wiley Eastern Ltd., 1st Edition, Eighth Reprint 1987.
2. C. R. Kothari, Research Methodology, Wiley Eastern Ltd., Fourth Reprint 1989.
3. R. P. Misra, Research Methodology, Concept Publishing Company, New Delhi, 2002.
4. R. Gopalan, Thesis Writing, Vijay Nicole Imprints Private Limited, 2005.
5. P. Ramadass and A. Wilson Aruni, Research and Writing: Across the Disciplines, MJP Publishers, 2009.
6. N. Gurumani, Scientific Thesis Writing and Paper Presentation, MJP Publishers, Chennai, 2010.
7. S. C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi, 1999.
8. G. W. Snedecor and W. G. Cochrans, Statistical Methods, Lowa State University Press, 1967.
9. R. Panneerselvam, Research Methodology, Prentice Hall of India Private Ltd., New Delhi, Abridged, 1st January 2013.
10. Satarkar, S. V., Intellectual Property Rights and Copyrights, Ess Ess Publications, 2003.
11. Anthony M Graziano and Michael L Rau, Research Methods: A Process of Inquiry, Prentice Hall, 2006.
12. P. Rajammal and P. Devadoss, A Hand Book of Methodology of Research, R. M. M. Vidya Press, 1976.
13. H. F. Ebel, C. Bliefert and W. E. Russey, The Art of Scientific Writing: From Students Reports to Professional Publications in Chemistry and Related Fields, VCH, Weinheim, New York, 1987.

OER:

1. https://www.google.com/url?sa=t&source=web&rct=j&url=https://dinus.ac.id/repository/docs/ajar/Kothari_-_Research_Methodology_Methods_and_Techniques_-

_2004.pdf&ved=2ahUKEwiS3M7WsMzrAhWDcn0KHZU7AV8QFjAKegQICBAB&usg=AOvVaw00Lf_VgXYG-96PVmSGC0DG
2. http://www.insaindia.res.in/pdf/Ethics_Book.pdf - pages 35-43
3. http://ccc.chem.pitt.edu/wipf/Web/HCH.pdf