



ALAGAPPA UNIVERSITY

(Accredited with 'A+' Grade by NAAC with 3.64 CGPA in the Third Cycle)

SCHOOL OF CHEMICAL SCIENCES
KARAIKUDI, TAMIL NADU, INDIA - 630 003



RESEARCH METHODOLOGY IN CHEMICAL SCIENCES (June 2023 onwards)

Unit I. Search of Literature

Primary sources – journals – periodicals – patents – abstracts; Secondary sources including list of titles – reviews – annual reviews – treatises – serials – monographs and text books – encyclopedia – catalogues – index of tabulated data – Science citation index – Searching the chemical literature – location of journal article – materials on a given topic – information about specific compound – choosing a problem – Abstract of a research paper. Literature searching online – The CA file – Registry file and other data bases – Popular websites in Chemistry – Materials science – Physics and Biological Sciences.

Unit II. Introduction to IPR

Intellectual Property Rights (IPR) and Patents, Royalty – Developing technical specifications and patenting of energy conversion and storage materials – Nanomaterials – biomaterials – Catalysts – IPRs, and ownership of traditional knowledge – IPR impacts on Chemical sciences research in India. Technology transfer – Knowhow – entrepreneurship – royalty – industry liaison.

Unit III. Good Laboratory Practices and Safety

Definition – Principles – Good Laboratory Practices (GLP) – Application. Stepwise implementation of GLP and Compliance monitoring. Safe working procedure and Protective environment – Protective apparel – Emergency procedure and first aid – Laboratory ventilation – Safe storage and use of hazardous chemicals – Procedure for working with substance that pose hazards – Flammable or explosive hazards – Procedure for working with gases at pressures above or below atmospheric – Safe storage and disposal of waste chemicals – Recovery, recycling and reuse of laboratory chemicals – Procedure for laboratory disposal of explosives, identification, verification and segregation of laboratory waste – Disposal of chemicals in the sanitary sewer system – Incineration and transportation of hazardous chemicals.

Unit IV. Advanced Instrumentation Techniques

Separation Techniques – Column, paper, thin layer and gas chromatography – HPLC – Ion exchange chromatography. Spectroanalytical Techniques – Principle – instrumentation and applications of colorimetric – flame photometry – atomic absorption spectroscopy and atomic emission spectroscopy. Spectroscopic Techniques – Principle – instrumentation and applications of UV-Visible spectroscopy – FTIR spectroscopy- Mass spectroscopy – NMR (H^1 and ^{13}C) spectroscopy – EPR spectroscopy – ESCA (XPS) – Auger electron spectroscopy. Principle, instrumentation and applications of the following techniques: XRD – DSC – TG/DTA – SEM – AFM - STM and TEM – Cyclic voltammetry – Electrochemical impedance spectroscopy – Electrochemical quartz crystal microbalance.



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Unit V - Error Analysis

Classification of errors – accuracy – precision – minimization of errors – significant figures. Mean, median, and standard deviation – Random and normal errors – Comparison of results – Student's t-distribution and t-tests – Curve fitting – Linear regression – regression line – correlation coefficient – Multiple linear regression (one variable with two other variables). Statistical software packages – SPSS and Mathematica.

REFERENCE BOOKS

1. J. March (2007). *Advanced organic chemistry, reaction, mechanism and structure 6th Ed.* Wiley interscience.
2. Coghill, A.M., and Gardson, L.R., (2006). *The ACS style guide- effective communication of scientific information, 3rd Ed.* oxford university press.
3. Anderson, J. (1970) *Thesis and Assignment Writing.* Wiley. Handbook Good Laboratory Practice Quality practices for regulated Non clinical research and development.
4. Chemical safety matters-IUPAC-IPCS, Cambridge University, Press, 1992.
5. Willa, Y., Garnar, Meureen, S., Barge and James P. *Good Laboratory Practice Standard: Application for field and laboratory studies* ACS Professional Reference Book.
6. Cochran, W.L., (1967). *Statistical Methods.* Oxford and IBH Publication, New Delhi.