CHEM 670: RESEARCH METHODOLOGY

Credit: 6
Pre-requisite: M.Sc. Chemistry or equivalent

Course Content:
Unit I : The Methodology
Literature survey - Journals, books and databases - Search Engines for chemistry research - Following the Bibliographic trail - Managing References. Research processes - scientific research, formation of the topic, hypothesis, conceptual definitions, operational definition, gathering of data, analysis of data, Revising of hypothesis, Managing chemical Data using Software - Conclusion. Errors in chemical analysis, classification of errors, determination of accuracy of methods - calibration of Data. Effective Presentation of Literature and research output in Orals and Posters - Processing of Images & animated content in Power-point presentations - Methodology of citing references. Publication of Research Papers - Articles, Communications, overviews and reviews - Identifying Avoiding Plagiarism - Principles for Clear writing - Effective Ways for Planning, Drafting and Revising Manuscripts - Using Templates & reference Managers.

Unit II: Lab Safety
Principles, Ethics and Practices Emergency response and containment - Fire emergencies in organic labs - Chemical spills - First Aid. Understanding and recognizing lab hazards -The language of safety - signs, symbols and Labels - MSDS and GHS. Toxic substances and biological agents - Acute and chronic toxicity - carcinogens - Bio-accumulation. Physical Hazards - Gas cylinders and cryogenics - High/low pressure hazards - Electric & Radiation Hazards. Chemical Hazards - Flammables, Corrosives and Explosives - Incompatibles - Runaway reactions. Managing Hazards - Eye, Face and skin Protection - Protective clothing, Gear and Respiratory. Managing Chemicals - Handling Waste - Storing inflammables and corrosives - Inventory and Self-Inspection.

Unit III : Handling of Instruments
Disciplinary Practices in handling various equipment - Maintenance - Logging & Trouble-shooting. Preparation of samples and Basic skills for handing IR/UV - NMR - XRD - EPR - CHN Analyser - GC - CV - Glove box Using Computational Facility - Available Copyrighted Chemical Software & Systems - Introduction to Gaussian 09 and other modelling software - Maintenance of Computers - Linux and Windows Basics - Hardware basics and Troubleshooting.

References:
1. Hill, R. H. Jr. & Finster, D. C. Laboratory Safety for Chemistry Students, 2nd Edn., John Wiley & Sons, 2016.
2. Booth, W. C. Colomb,G. G.; Williams, J. M. ; Bizup, J. ; FitzGerald W. T., The Craft of Research, 4th Edn, Univ. Chicago Press, 2016.
3. Alley, M., The Craft of Scientific Presentations, 3rd Edn., Springer, 2013.
4. Hibbert D. B; Gooding J. J., Data Analysis for chemistry, Oxford, 2016.