

Pre-Ph.D. CHEMISTRY SYLLABUS

(Effective from Academic Session: 2018-19)



**POST GRADUATE DEPARTMENT OF CHEMISTRY
NORTH ORISSA UNIVERSITY
SRIRAM CHANDRA VIHAR
BARIPADA, ODISHA-757 003**

Course Structure of Pre-Ph.D. in Chemistry

(Effective from Academic Year 2018-19)

| Sl. No | Course Title | Course Code | Credit | Full Mark |
|--------------|---|-------------|-----------|------------|
| 1. | Research Methodology | CH-801 | 05 | 50 |
| 2. | Techniques in Chemistry | CH-802 | 05 | 50 |
| 3. | Review or Dissertation work along with Seminar Presentation | CH-803 | 10 | 100 |
| Total | | | 20 | 200 |

Each Theory Paper should contain 05 Units

PROGRAMME OUTCOME:

- Gained knowledge about research, literature survey, scientific paper writing and communication
- Gained knowledge on instrumental techniques for the synthesis, analysis and characterization of synthesized compounds and prepared materials.

PROGRAMME SPECIFIC OUTCOME:

- Expected to gain basic knowledge on literature survey, scientific ethics and scientific writing
- Constructive analytical skill will be developed for studies on advanced research and industrial jobs
- Create a responsibility and awareness to maintain safer laboratory practice and systematic documentation

RESEARCH METHODOLOGY

OBJECTIVES

This course aims to equip the students with various methods adopted for research, statistical methods for data analysis and application of computers in chemistry research.

CONTENTS

UNIT-I

Scientific Research: Definition, characteristics, types, need of research, Identification of the problem, assessing the status of the problem, formulating the objectives, preparing design (experimental or otherwise), Actual investigation, determining the mode of attack.

UNIT-II

Literature Survey: Primary sources (Journals and Patents), Secondary resources (abstracts, CA, collective indexes, reviews, awareness service, general treatise, monographs on specific areas, reference books), Basic ideas of literature search on web (Scifinder, Scopus, Scirus, Science Direct), Citation index, Impact factor of research papers.

UNIT-III

Documentation and Scientific writing: Organization and writing of manuscript/paper, monographs, authored books and edited books, Thesis writing, Structure and Components of Research Report, Types of Report: research papers, thesis, Research Project Reports, Pictures and Graphs, citation styles, writing a review of paper, Bibliography, research ethics and Plagiarism check.

UNIT-IV

Statistical Methods of Data Analyses: Fundamental of statistical analyses- types, mean, median, mode, range, variance, standard deviation, Test for rejection of outliers (Q test), Levels of confidence and significance, Test of significance (F-test, student T-test, paired T-test), Least square methods of fitting linear equations, (simple linear cases and weighted linear case), correlation coefficient and coefficient of determination.

UNIT-V

Computer Applications in Chemistry: Computer software and chemistry, Computer technique used in chemistry with special reference to UV-Visible spectroscopy,

chromatography, mass spectroscopy, Applications of some computer packages (MS-Excel, Origin, Chem draw) to chemistry.

COURSE OUTCOME:

After completion of this course a student can able to

- Write research article/research paper/project report/own thesis or dissertation.
- Select the suitable journal to publish the research work.
- Know various statistical methods for data analysis.
- Apply computer technique for spectral analysis.
- Know various computer packages like MS-Excel, Origin, Chem draw etc.

Books Recommended

1. Research Methodology - Methods & Techniques, C.R. Kothari, Wiley Eastern Ltd. New Delhi 1985.
2. Research Methodology - A step by step Guide for Beginners 2nd edn. Kumar Ranjit, Pearson Education, Singapore, 2005.
3. Introduction to Research & Research Methodology. M.S. Sridhar.
4. Analytical Chemistry, G.D. Christian, 6th Edn, Wiley Student Edition.
5. Computer for Chemists, S.K. Pundir & A. Bansal, Pragati Prakashan 2008.
6. Nomenclature for the presentation of results of chemical analysis. (IUPAC Recommendations 1994) *Pure and Appl. Chem.* Vol.66, No. 3, pp.595-608,1994.
7. B.S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell, Vogel's Text Book of Practical Organic Chemistry, 5th Edition, Pearson, New Delhi, 1989.

Techniques in Chemistry

CH-802

Marks-50 (5 Credits)

OBJECTIVES:

The objective of the course is to get an in-depth idea about different tools and techniques for Synthesis. Characterization and analysis of organic and inorganic compounds including materials.

CONTENTS:

Unit -I

General Safety measures and methods of Organic Synthesis

General methods in Organic Synthesis, Purification of solvents and reagents, Identification and purification of intermediates (Column chromatography and TLC), Techniques for performing reactions such as in inert atmosphere, Low Temperature and high Pressure

General methods of Complex Compounds

General methods of preparation of simple and complex (e.g. Schiff bases) ligands, General methods of preparation of coordination compounds (mono and binuclear complexes) and their purification by different methods.

UNIT-II

General methods of Material Synthesis

Principle of co-precipitation, solid state reaction, sol-gel, Hydrothermal and chemical vapour deposition methods for synthesis of materials with examples including simple and composite materials

Unit-III

Spectroscopic Techniques

FT-IR spectroscopy, UV-Visible Diffuse Reflectance Spectroscopy, Fluorescence Spectroscopy, Principle and applications of material characterizations, NMR: Applications of NMR (^1H , ^{13}C , ^{31}P , ^{23}Al) for characterization

Unit-IV

Thermal Techniques

Differential thermal analysis (DTA): Principle, instrumentation and applications of DTA
Thermogravimetry: Principle, instrumentation and applications of DTA, correlation of DTA and TGA data

Differential Scanning Colorometry (DSC): Principle and applications

Unit-V

Phase identification and surface properties

Principles of X-ray powder diffraction, Sample preparation and mounting for X-ray powder diffractometry, particle size requirement, sample thickness and uniformity, recording X-ray powder diffraction pattern, Data acquisition, processing and phase analysis, use of crystallographic data base, phase identification and quantitative analysis, Different methods for quantitative phase analysis, Principles and measurement of surface area by BET method

COURES OUTCOMES:

On completion of the course the student will be able to

- Know the different techniques for synthesis of organic and inorganic compounds
- Acquire knowledge on principle and applications of P-XRD, UV-Vis, FT-IR, NMR and Fluorescence Spectroscopy etc.
- Gained knowledge how to characterize the materials by thermal analysis

Books Recommended

1. Chemistry of Advanced materials-An overview, Ed By L. V. Interrante and M. J. Hampden-Smith VCH (1998)
2. Coordination compounds by S. F. A Kettle
3. Introduction to Instrumental Analysis. R. D. Braun. Pharma Med Press
4. Spectroscopic methods in Organic Chemistry, D. H. Wilhams, I. Flemming, Tata Mcgrow
5. Vogel Text book of Practcal Organic Chemistry, Fifth Edition, Pearson Education.

CH-803

Marks-100 (10 Credits)

PROJECT DISSERTATION

Review or Dissertation work along with seminar presentation