

SYLLABUS
FOR
Ph. D COURSE WORK IN CHEMISTRY
UNDER SEMESTER SYSTEM



P.G. DEPARTMENT OF CHEMISTRY
GANGADHAR MEHER UNIVERSITY, SAMBALPUR
ODISHA

P.G. Department of Chemistry, G.M. University

Syllabus for Ph. D Course work

The Ph.D Course work in Chemistry spans a period of six months for January/July session beginning from 1st January to 31st July or 1st June to 31st December comprising of one semester with the following course structure. Each theory paper i.e CH 711, P-712 and P-713 carries 100 marks out of which 20 marks are for internal assessment examination. There will be one internal assessment examinations for each theory paper. The duration of an examination for each theory examination is 3 hours. The paper CH-714 carries 200 marks which does not have internal examination. The pattern of teaching and examination involved in PhD course work is displayed in the Table given below for 2024 batch.

Semester	Paper Code	Nomenclature	Maximum Marks	Credit
Semester - I	CH-711	Recent Trends in Chemistry	100 (80 + 20)	04
	P-712	Publication and Research Ethics	100 (80 + 20)	04
	CH-713	Research Methodology	100 (80 + 20)	04
	CH-714	Review Work and Seminar	200 (Report- 100, Presentation-25, Viva Voce- 25, Seminar -50)	08
Complete Course			500	20

SEMESTER - I

Recent Trends in Chemistry

CH-711

Full Marks: 100(4 Cr)

Unit: I Nanomaterials and their applications (1Cr: 10-12 lectures)

Introduction to nanomaterials, Physicochemical properties of nanomaterials (Optical, Electrical, Electronic Redox, Mechanical, Magnetic and catalytic). Synthesis and Preparation of nanostructured oxides, bimetallic nanomaterials, magnetic nanomaterials supported on graphene, oxides.

Applications of nanomaterials on corrosion, water purification, Energy, and Environment, Special applications of nanomaterials on photocatalysis, coating, sensor, energy storage, and fluorescence.

Unit: II Homogeneous Catalysis (1Cr: 10-12 lectures)

Introduction to homogeneous catalysis, Terminology in catalysis: TO (Turnover), TON (Turnover number), TOF (Turnover frequency), enantioselectivity, stereoselectivity, chemoselectivity, regioselectivity, asymmetric catalysis.

Hydroformylation: Importance, Cobalt catalyst for hydroformylation, Phosphine modified cobalt catalysis, Rhodium-Phosphine catalyst, Factors affecting n/iso ratio of hydroformylation product, Enantioselective hydroformylation.

Methanol Carbonylation: Monsanto process of conversion of methanol to acetic acid, British Petroleum's Cativa Process using Iridium catalyst,

Olefin Oxidation: The Wacker Process of oxidation of ethylene using Palladium catalyst. Ube's oxalate process using Palladium catalyst

Unit: III Advanced Spectroscopy (1Cr: 10-12 lectures)

NMR, IR and Mass Spectroscopy:

a) IR spectroscopy: Applications of IR in analysis. NMR spectroscopy: Chemical shifts, and coupling constant, Introduction of NOE, DEPT and 2D NMR, ^{13}C NMR and its applications. Mass spectroscopy: Mass spectral fragmentation of complex molecules and its applications.

Combined spectroscopic problems based on IR, NMR, and mass spectral data.

Fluorescence Spectroscopy: Introduction, Phenomenon and characteristic of fluorescence, fluorescence life time. Fluorescence quenching, types of quenching processes, Instrumentations, experiments for fluorescence quenching measurements, Applications in development of analytical techniques and understanding the molecular interactions

Unit: IV Instrumentation and Analytical Techniques (1Cr: 10-12 lectures)

a) Principles and instrumentation of Mossbauer SPECTROSCOPY, Raman, AES, AAS

b) X-ray Diffraction, XPS, EDX and TEM: Principle instrumentation and application of X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS) and electron spectroscopy for chemical analysis (ESCA), transmission electron microscopy (TEM), Scanning electron microscopy (SEM).

References:

1. Chemistry of nanomaterials: Synthesis, properties and applications - CNR Rao et.al.
2. Nanoparticles: From theory to applications, Wiley Weinheim , 2004 - G. Schmidt,.
3. Instrument E L Principe, P Gnauck and P Hoffrogge, Microscopy and Microanalysis (2005), 11: 830- 831, Cambridge University Press.
4. Processing & properties of structural nanomaterials - Leon L. Shaw
5. Environmental Chemistry for a Sustainable World, Volume 1: Nanotechnology and Health Risk Editors: Lichtfouse, Schwarzbauer, Robert
6. Advances in Nanotechnology and the Environment, CRC Press, Taylor and Francis Group - Juyoung Kim
7. The chemistry of nanomaterials: Synthesis, properties and applications, Wiley VCH Verlag GmbH&Co, Weinheim, 2004 - C.N.R.Rao, A.Muller, A.K.Cheetham (Eds)
8. Nanostructures and Nanomaterials: Synthesis, properties and applications, Imperial College Press, 2004 - G.Cao
9. Carbon Nanomaterials for Environmental and Biological Applications, Bergmann and Machado. Springer.
10. Basic Organometallic Chemistry, Concept, Synthesis and Applications, Universities Press- B. D. Gupta and A. J. Elias
11. Applied Homogeneous Catalysis, Wiley VCH, Weinheim, 2002- B. Cornils, W. A. Hermann
12. Recent Achievements, Trends and Prospects in Homogeneous Catalysis, F. J. Waller, Journal of Molecular Catalysis, 31 (1985) 123 - 136
13. Instrumental Methods of Analysis – H.H. Willard, L.L.Merritt, J.a.Dean, F.A. Settle, CBS Publishers & Distributors, 1986.
14. Principles of Instrumental Analysis: D.Skoog & West
15. Analytical chemistry - AI Vogel
16. Instrumental methods of analysis - BK Sharma
17. Instrumentation - Chatwal and Chatwal
18. Instrumentation - Upadhyaya and Upadhyaya

PAPER-712

PUBLICATION AND RESEARCH ETHICS

Unit-I: SCOPE, PHILOSOPHY AND ETHICS OF RESEARCH AND ETHICS

- i) Introduction and Scope
- ii) Introduction to philosophy: definition, nature and scope, concept, branches
- iii) Ethics: definition, moral philosophy, nature of moral judgments and reactions, Research ethics, Institutional ethics committee.
- iv) Ethics with respect to science and research
- v) Intellectual honesty and research integrity

Unit-II: SCIENTIFIC CONDUCT

- i) Research problem: Identification, Selection, Formulation of research objectives
- ii) Research design: Components, Types and Importance
- iii) Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP)
- iv) Redundant publications: duplicate and overlapping publications, salami slicing
- v) Selective reporting and misrepresentation of data

Unit-III: TECHNICAL WRITING

- i) Literature search technique, using SCOPUS, Google Scholar, PUBMED, Web of science, Indian Citation Index, and RG
- ii) Types of technical documents; Full length research paper, Short/Brief communications, Letters to editor, Book chapter, Review, Conference report, Project proposal Components of a full length research paper; , Rationale of the paper, Aims and objectives, Hypothesis building, Work plan, Materials and methodology, Results and discussion, Conflict of interest statement,
- iii) Components of a research proposal; Project summary Key words, Origin of the proposal, Major objectives Methodology, Instrument facility available in the PI's department, Overview of status of Research and Development in the subject, Importance of the proposed project in the context of current status.
- iv) Styles of referencing; APA, MLA, Oxford, Harvard, Chicago, Annotated bibliography, Tools for citing and referencing, Grammarly, Endnote etc, How to cite and how to do referencing

Unit-IV: **PUBLICATION ETHICS**

- i) Publication ethics: definition, introduction and importance
- ii) Best practices / standards setting initiatives and guidelines: COPE, WAME, etc.
- iii) Conflicts of interest
- iv) Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types
- v) Violation of publication ethics, Subject specific ethical issues, FFP, authorship,
- vi) Identification of publication misconduct, complaints and appeals
- vii) Predatory publishers and journals
- viii) Plagiarism-Pitfall
- ix) Use of plagiarism software like Turnitin, Urkund and other open source software tools, . Complaints and appeals: examples and fraud from India and abroad

CH- 713

RESEARCH METHODOLOGY

Unit-I: IPR AND CYBER LAW.

- i) Patents, Patent laws, process of patenting a research finding
- ii) Intellectual property (IP), Intellectual property right (IPR)
- iii) Copyright, Trademarks, GI
- iv) Cyber laws
- v) COPE

Unit-II: ADVANCED TOOLS & TECHNIQUES IN RESEARCH

- i) Indexing databases
- ii) Citation databases: Web of Science, Scopus, etc.
- iii) Research Metrics
- iv) Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score
- v) Metrics: h-index, g index, i10 index, altmetrics
- vi) Open access publications and initiatives
- vii) SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies
- viii) Software tool to identify predatory publications developed by SPPU
- ix) Journal finder /journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

Unit III: COMPUTER FUNDAMENTALS

- i) Introduction to MS-Office software: MS-Word(Track change)
- ii) MS-Excel
- iii) MS-Power Point
- iv) Features for Statistical Data Analysis Tool Pack, SPSS
- v) Tables, Figures and Pictures using Excel
- vi) Preparation of Posters
- vii) Electronic submission of manuscripts
- viii) Communication skills, oral and poster

Unit-IV: COMPUTER SOFTWARE APPLICATIONS IN CHEMISTRY

- i) Basic ideas on the use of Internet in Chemistry education
- ii) Applications and uses of common softwares in chemistry, Origin,
- iii) Chemdraw

- iv) Chemsketch,
- v) XPS PEAK4.1,
- vi) Mendeley & Endnote - Reference manager

References:

1. Mastering Internets - Coleman P and Dyson P
2. How the Internet Works - Gralla P
3. Inside Microsoft Office Professional - Cassel P *et al.*
4. Microsoft Office 2003 All in One, Microsoft Office 2010 In Depth - Habraken J
5. Microsoft 2007: Introductory Concepts and Techniques - Shelly GB, Vermaat ME, Cashman TJ
6. Statistical Methods - Snedecor GW & Cochran WG
7. Computers: Concepts & Uses - Sumner M
8. How Computers Work - White R
9. Cyber Law Simplified - Sood V
10. Cyber Law - Kumar Anupa P
11. Plagiarism: Why it happens, How to prevent it? - Gilmore B
12. Perspectives on Plagiarism and Intellectual Property in a Post-Modern World- Buranen L and Roy AM
13. Biostatistical Analysis - Zar JH
14. Research Methodology - R Panneerselvam
15. Research Methodology: Methods & techniques, 2008 - CR Kothari

CH-714

Review Work and Seminar

Full Marks: 200 (8 Cr)
