

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 beginning from 1st January to 31st July comprising of one semester with the following course structure. Each theory paper i.e CH 711, CH712 and Ch713 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 CH714 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 2018 batch.

Semester	Paper Code	Nomenclature	Maximum Marks	Credit
Semester - I	CH-711	Recent Trends in Chemistry	100 (80 + 20)	04
	CH-712	Research Methodology - I	100 (80 + 20)	04
	CH-713	Research Methodology - II	100 (80 + 20)	04
	CH-714	Review Work	200 (Written150, Presentation-25, Viva Voce- 25)	08
Complete Course			500	20

SEMESTER - I

Recent Trends in Chemistry

CH-711

Full Marks: 100(4 Cr)

Unit: I Nanomaterials

(1Cr: 10-12 lectures)

Definition, Types of nanostructures, Properties and Applications:

One dimensional, Two dimensional and Three dimensional nanostructured materials, Quantum Dots shell structures, metal oxides, semiconductors, composites, mechanical-physical-chemical properties, application as ferroelectric materials, coating, molecular electronics and nanoelectronics, biological and environmental, membrane based application, polymer based application, nanocatalysis, basic principle.

Nanosensors:

Introduction to sensors. Characteristics and terminology - static and dynamic characteristics. Micro and nano-sensors, Fundamentals of sensors, micro fluids, Packaging and characterization of sensors, Sensors for aerospace and defense, Organic and inorganic nanosensors, Biosensors: Magnetic Nanoparticles for Imaging and Therapy, Clinical diagnostics, generation of biosensors, Nanomaterial based biosensors, Biosensors based on nucleotides and DNA, Electron transfer of biomolecules, Photodetectors, Nanophotonics, Nanoelectronic Devices, Biosensors,

Unit: II Advanced Spectroscopy

(1Cr: 10-12 lectures)

Determination of organic and inorganic molecules using UV, FTIR, NMR and mass spectroscopy. Principles and instrumentation of Mossbauer SPECTROSCOPY, PES, XPS, Raman, AES, AAS

Unit:III Supramolecular Chemistry

(1Cr: 10-12 lectures)

Concepts of Supramolecular Chemistry: Definition, Nature of supramolecular interactions, Host-guest interaction, Molecular recognition, Types of recognition. Cation-binding Hosts: Concepts, Cation receptors, Synthesis and structure of crown ethers, lariat ethers, podands, cryptands, spherands, calixarenes, Selectivity of cation complexation, Macrocyclic and template effects. Anion-binding Hosts: Concepts, Anion host design, Anion receptors, Shape and selectivity, Cation hosts to anion hosts, pH effect. Neutral receptors: Clathrates, cavitands, cyclodextrins, cyclophanes. Self-assembly molecules: Design, synthesis and properties of the molecules, Self assembling by H-bonding, Metal-ligand interactions and other weak interactions, metallomacrocycles, catenanes, rotaxanes, helicates and knots.

Applications of Supramolecular Chemistry: Rational Design, molecular electronic devices, molecular wires, molecular rectifiers, molecular switches, molecular logic. cyclodextrins as enzyme mimics, ion channel mimics, supramolecular reactivity and catalysis.

Unit: IV Homogeneous Catalysis

(1Cr: 10-12 lectures)

Catalysis: Terminology in catalysis, TO(Turnover),TON(Turnover number), TOF(Turnover frequency), Sequences involved in a catalysed reaction, Other terms used in catalysis, enantioselectivity, stereoselectivity, chemoselectivity, regioselectivity, Asymmetric synthesis using a catalyst.

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 and Olefin Oxidation: Monsanto process of conversion of methanol to acetic acid, Celanese process using LiI modified Rhodium catalyst, Tennessee Eastman acetic anhydride process using Rhodium catalyst, British Petroleum's Cativa Process using Iridium catalyst, The Wacker Process of oxidation of ethylene using Palladium catalyst.

Ube's oxalate process using Palladium catalyst, Carbamate synthesis using catalysts of Platinum group metals, Propionic acid synthesis using Ruthenium catalyst

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 naomaterials - 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. Chemical Sensors and Biosensors, Wiley; New York, Chichester, 2002 - Brian R Eggins.
8. Biosensors: A Practical Approach, Oxford University Press, 2004 - J. Cooper & C. Tass,
9. Nanomaterials for Biosensors, Wiley - VCH, 2007 - Cs. Kumar
10. 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)
11. Naostructures and Nanomaterials: Synthesis, properties and applications, Imperical College Press, 2004 - G.Cao
12. Handbook of nanoscience, Engg. and Technology, CRC Press, 2002 - W. Gaddand, D. Brenner, S. Lysherski and G. J. Infrate (Eds)
13. Physical properties of Carbon Nanotube-R Satio
14. Carbon Nanotubes: Properties and Applications- Michael J. O'Connell
15. Nanotubes and Nanowires, RCS Publishing - CNR Rao and A Govindaraj
16. Nanoscale materials -Liz Marzan and Kamat
17. Carbon Nanomaterials for Environmental and Biological Applications, Bergmann and Machado. Springer.
18. Supramolecular Chemistry, Wiley, 2000- J. W. Steed and J. L. Atwood
19. Supramolecular Chemistry- Concepts and Perspectives,Wiley-VCH, 1995 - J. M. Lehn
20. Supramolecular Chemistry, Oxford University Press, 1999 - P. D. Beer, P. A. Gale, D. K. Smith
21. Molecular Self-assembly, Organic Versus Inorganic Approaches, Springer, 2000 - M. Fujita
22. Core Concepts in Supramolecular Chemistry and Nanochemistry, John Wiley & Sons, 2007 - Jonathan W. Steed, David R. Turner, Karl J. Wallace,
23. Basic Organometallic Chemistry, Concept, Synthesis and Applications, Universities Press- B. D. Gupta and A. J. Elias
24. Applied Homogeneous Catalysis,Wiley VCH, Weinheim, 2002- B. Cornils, W. A. Hermann
25. Homogeneous Catalysis, John Wiley, 2002 – S. Bhaduri and D. Mukesh
26. Recent Achievements, Trends and Prospects in Homogeneous Catalysis, F. J. Waller, Journal of Molecular Catalysis, 31 (1985) 123 - 136

PAPER-612/712

RESEARCH METHODOLOGY-I

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

PAPER- 713
RESEARCH METHODOLOGY-II

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: QUANTITATIVE DATA ANALYSIS

- i) Types of Data, Data Collection – Methods and Tools
- ii) Hypothesis testing
- iii) Normal and Binomial distributions and their property
- iv) Tests of significance: Student *t*- test, *F*- test, *Chi-square* test
- v) Correlation and Regression
- vi) ANOVA – One-way and Two-way, Multiple-range test

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: 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.

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
16. Analytical chemistry - AI Vogel
17. Instrumental methods of analysis - BK Sharma
18. Instrumentation - Chatwal and Chatwal
19. Instrumentation - Upadhyaya and Upadhyaya

CH-714

Review Work

Full Marks: 200 (8 Cr)
