

Course Work for Ph.D. (Chemistry)



(Effective from January 2022 onwards)

Department of Chemistry
School of Physical Sciences
Guru Ghasidas Vishwavidyalaya
Bilaspur-495 009

Course Work for Ph.D. (Chemistry)
(To be implemented from the Session 2021-22)

A. School-Specific Common Courses:

S. No	Title of the paper	Paper Type	Credits
SPC-R1	Research Methodology & Computer Applications	Common course Compulsory	4

B. Discipline-Specific courses: Total 10 credits: All these courses are compulsory to each student.

S. No	Title of the paper	Paper Type	Credits
CH-R1	Modern Techniques in Chemical Sciences	Compulsory for Chemistry	4
CH-R2	Emerging Area in Chemical Sciences	Compulsory for Chemistry	4

C. Research theme-specific courses:

6 credits

S. No	Title of the paper	Paper Type	Credits
CH-R3	Seminar on research topic with written report by student Mode of study includes: Assigning the topic to students based on their basic background and presentation in the form of seminar which will be followed by discussion and submission of the write-up. This will be evaluated by group of teachers.	Successful	No Credit

Research Methodology, Publication Ethics and Computer Applications

Unit 1: Philosophy and Ethics

Introduction to philosophy: definition, nature and scope, concepts, branches, Ethics: definition, moral philosophy, nature of moral judgements and reaction.

Unit 2: Research methodology

Definition of Research, Components of Research Problem, Various Steps in Scientific Research: Hypotheses, Research Purposes, Research Design, Literature searching, Literature Survey, defining the question and formulating hypothesis/ hypothesizes, Collection of research data, tabulating and cataloging. Sampling and methods of data analysis.

Unit 3: Laboratory practices and safety guidelines:

Safe working procedure and protective environment, Laboratory safety measures, Handling radiation, Chemical hazards and their types, Safe chemical use, Proper storage and disposal of hazardous materials, Bio-hazardous and other toxic experimental materials, Maintenance of equipments.

Unit 4: Computer applications in scientific writing skills

Curve fitting, Method of least square fit, least square fit (straight line) to linear equations and equation reducible to linear equations. Back ground correction and mathematical manipulation in data using **origin**.

Structure and Components of Research Report, Types of Report: research papers, thesis, Research Project Reports, Pictures and Graphs, citation styles, writing manuscript in Latex, Steps to better writing.

Types of errors; mean deviation, standard deviation and probable errors; propagation of errors with summation, difference, product and quotient, Estimates of Means and Proportions; Chi-Square Test.

Unit 5: Ethics in Science and Research Publication

The source of ethical issues in science: examples from Physical Sciences.

Publication ethics: definition, introduction and importance, Best practices/standards setting initiatives and guidelines: COPE, WAME, etc., Conflicts of interest, Publication misconduct: definition, concept, problems that leads to unethical behavior and vice versa, types, Violation of publication ethics, the problem of plagiarism and related issues , authorship and contributorship, Identification of publication misconduct, complaints and appeals, Predatory publishers and journals.

IPR and Patent regime: Recording and storage/retention of recorded materials. Management and use responsibilities in proper utilization of the facilities. Socio-legal issues, originality

[Handwritten signatures and initials]

References:

1. "How to write and Publish" by Robert A. Day and Barbara Gastel, (Cambridge University Press).
2. "Survival skills for Scientists" by Federico Rosei and Tudor Johnson, (Imperial College Press).
3. "How to Research" by Loraine Blaxter, Christina Hughes and Malcum Tight, (Viva Books).
4. "Probability and Statistics for Engineers and Scientists" by Sheldon Ross, (Elsevier Academic Press).
5. "The Craft of Scientific Writing" by Michael Alley, (Springer).
6. "A Students's Guide to Methodology" by Peter Clough and Cathy Nutbrown, (Sage Publications).
7. Bird, A. (2006). Philosophy of science. Routledge.
8. MacIntyre, Alasdair (1967) A Short History of Ethics. London.
9. P: Chaddah, (2018) Ethics in Competitive Resemh: Do not get scooped; do not get plagiarized, ISBN:97-9387480865.
10. Beall J. (2012), Predatory publishers are corrupting open access. Nature, 489(7415)179. <https://doi.org/10.1038/489179a>
11. Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance (2019), ISBN:978-81-939482-1-7. http://www.insaindia.res.in/pdf/Ethics_Book.pdf.

Handwritten signatures and initials in blue ink:

- Top left: A signature that appears to be "S. Ghosh" and another signature "H. Ghosh".
- Top middle: A signature "A. Chaddah" with "Chaddah" written below it.
- Top right: A signature "L. Sinha" and another signature "White".
- Middle right: A signature "S. Ghosh" with "S" written below it.
- Middle left: A signature "D. Ghosh" with "D" written below it.
- Bottom left: A signature "P. Ghosh" with "P" written below it.
- Far right: A signature "S. Ghosh" with "S" written below it.

Paper II

Credit 6

CH-R1 Modern Techniques in Chemical Sciences

1. Basic theory, instrumentation and analytical applications: Spectroscopic techniques [NMR, ESR, MS (EI, FAB, MALDI-TOF), IR, UV-Vis, Fluorescence and Phosphorescence, Atomic Absorption, Biosensors.
2. **Techniques for Materials Characterization**
Basic theory and analytical applications of the following physical methods: X-ray diffraction methods (single crystal and powder method), Thermoanalytical methods (TGA, DSC, DTA), Microscopic methods (SEM, TEM, AFM), Surface Properties (XPS, BET), Cyclic Voltammetry, SQUID.
3. **Separation Techniques:**
Introduction, classification of chromatographic methods, terms and relationships in chromatography, sample characterization High performance liquid chromatography (HPLC), Gas chromatography (GC) and ion exchange chromatography, GPC.

Principle, Instrumentation and Application of :
Reverse Osmosis (RO), Nanofiltration (NF), Ultra Filtration (UF) and Micro Filtration (MF), gel electrophoresis, chiral separations.
4. **Computational Chemistry:** Theoretical Chemistry a quantum approach, MO theory, Ab initio calculation, Geometry optimization, basis set, electronic structure calculations.,

Books Recommended

1. F.W Fifield & D.Keal, Principles and Practice of Analytical chemistry Blackwell Publishing Company, (2004)
2. Pradyot Patnaik, (2004), Dean's Analytical chemistry, Hand Book Second edition McGraw- Hill Hand Books
3. J. D Seader /Ernest J. Henley, Separation Processes Principles; John Wiley & Sons Inc. N.Y. (1998)
4. Skoog, Holler, Nieman, H.B Principles of Instrumental Analysis Fifth edition College publishers.
5. G.H. and H. Freiser, Solvent Extraction in Analytical Chemistry, 1st edition (1958), John Wiley, New York.
6. B. L. Karger, L.R. Snyder and C. Howarth, An Introduction to Separation Science, 2nd Edition (1973) John Wiley, New York.
7. E.W. Berg, Chemical Methods of Separation, 1st edition (1963), McGraw Hill New York.
8. D.G. Peters, J.M.Hayes and C.M. Hieftj, Chemical Separation and Measurements, 2nd edition 1974, Saunders Holt, London.
9. R.M. Silverstein and F.X. Webster, Spectroscopic Identification of Organic Compounds, 6th Edition (2003) John Wiley, New York.F
10. J.R.Dyer, Application of Absorption Spectroscopy of Organic

- Compounds, Prentice Hall, New Delhi (1978).
11. J.M. Hollas, *Modern Spectroscopy*, 4th edition (2004), John Wiley and Sons, Chichester.
 12. C.N. Banwell and E.M. Mc Cash, *Fundamentals of Molecular Spectroscopy*, 4th edition (1994), Tata McGraw Hill, New Delhi.
 13. R. S. Drago, *Physical Methods in Chemistry*, International Edition (1992), Affiliated East-West Press, New Delhi.
 14. D.A. Skoog, F.J. Holler and T.A. Nieman, *Principles of Instrumental Analysis*, 5th Edition (1998), Harcourt Brace & Company, Florida.
 15. H.A. Strobel, *Chemical Instrumentation – A Systematic Approach*, 2nd Edition (1973), Addison Wesley, Mass.
 16. R.L. Pecsok, L. D. Shields, T. Cairns and L.C. Mc William, *Modern Methods of Chemical Analysis*, 2nd Edition (1976), John Wiley, New York.

CH-R2: Thrust Area in Chemical Sciences

- 1. Emerging Green Chemistry:** Green chemistry, introduction, 12 principles, Solvent-free synthesis; Environmentally benign solvents: Water and Ionic liquids as green solvents and catalysts in organic synthesis. Microwave in chemical synthesis: Basic principles, advantages and examples. Sonochemistry and green aspects;
- 2. Nano-Chemistry:** Introduction, Nucleation and growth, heterogeneous nucleation, Size effect, Synthesis and assembly, techniques, General methods of preparation and synthesis. Types of nano materials, their Properties and applications. Carbon nanotube, micro- and mesoporous materials.
- 3. Formation of Carbon-Carbon bonds via organometallic reagents:** (i) Palladium-Catalyzed Coupling Reactions, (ii) Organoboron Reagents, (iii) Organozinc Reagents, (iv) Organocopper Reagents.
- 4. Multicomponent reactions (MCRs):** Definition, Advantages and examples particularly, Ugi reaction, Biginelli reactions, Strecker amino acid synthesis, Passerini synthesis, Mannich reaction,
- 5. The chemistry of molecular recognition:** Host and Guest Chemistry. Supramolecular interactions and their characterization, Supramolecular catalysis and transport processes, Cyclodextrin- a naturally occurring cyclic host, calixarene- a versatile host; Chemosensor, Electrochemical sensors, Origin and source of chirality, chiral ligands, chiral drugs, asymmetric epoxidation
- 6. Polymers:** Mechanism and kinetics of radical, condensation and living radical polymerizations. Spectroscopic characterization and testing of polymers. Measurement of molecular weights: viscosity, light scattering, osmotic and size exclusion chromatographic method. Properties and applications of commercial polymers: polyamides, polyesters, phenolic resins, epoxy resins and silicones. Fire retarding polymers, conducting polymers, and biocompatible polymers.

Books Recommended

1. Mike Lancaster, Green Chemistry: An Introductory Text, Royal Society of Chemistry, 2002.
2. Nina Hall(Editor-in-chief), The new Chemistry, Cambridge university Press, 2000.
3. CNR Rao, Muller and Cheetham, The Chemistry of Nano Materials, Vol.I & II, Wiley-VCH (2005)
4. Geoffrey A. Ozin, and Andre Arsenette, Nano Chemistry, RSC Publishing, 2005
5. S.C. Tjong, Nano Crystalline Materials Elsevier, 2006
6. George S. Zweifel, Michael H. Nantz, Modern Organic Synthesis - An Introduction, 1st Edition, 2007; ISBN: 978-0-716-77266-8; Ed. W. H. Freeman
7. Dale L. Boger, Modern Organic Synthesis, TSRI press.
8. P. S. Kalsi, Organic Reactions and Their Mechanisms, 1st Edition (1996), New Age International Pub., New Delhi.
9. M. B. Smith, Organic Synthesis, (1998) Mc Graw Hill Inc, New York
10. J. Clayden, N. Greeves, S. Warren and P. Wothers, Organic chemistry, Oxford

- University press INC, New York, 2001
11. M.B. Smith & Jerry March, March's Advanced Organic Chemistry, 5th Edition (2001), John Wiley & Sons, New York.
 12. M. N. Hughes, Inorganic Chemistry of Biological Processes, 2nd Ed. (1981), John-Wiley & Sons, New York.
 13. W. Kaim and B. Schwederski, Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life, An introduction and Guide, Wiley, New York (1995).
 14. S. J. Lippard and J. M. Berg, Principles of Bioinorganic Chemistry, University Science Books, (1994).
 15. I. Bertini, H. B. Grey, S. J. Lippard and J. S. Valentine, Bioinorganic Chemistry, Viva Books Pvt. Ltd., New Delhi (1998).
 16. Ariga Katsuhiko, Kunitake Toyoki, Supramolecular chemistry- fundamentals and applications: advanced text book, Publisher: Iwanami Shoten Publishers, Tokyo, 2006.
 24. Jean Marie Lehn, Supramolecular chemistry: concepts and perspective, Wiley-VCH (June 1995).
 25. Crego-Calama, Mercedes Reinhoudt, Davis N. Ed. Supramolecular chirality, Topics in current Chemistry, vol 265, 2006, Springer Verlag.
 26. F. A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, 6th Edn., (1999), John-Wiley & Sons, New York.
 27. Catalysis: Principles and Application, editor(s) : B. Viswanathan, S. Sivasanker, A.V. Ramaswamy ISBN: 978-81-7319-375-0: (2007).
 28. Jacobsen, E.N., Pfaltz, A.; Yamamoto, H. (ed), Comprehensive Asymmetric Catalysis I-III; Springer Verlag: Berlin, 1999.
 29. Textbook of Polymer Sciences, F. W. Billmeyer Jr, Wiley.Polymer Sciences, V. R. Gwariker, N. V. Vishwanathan and J. Sreedhar, Willey-Eastern.
 30. Functional Monomers and Polymers, K. Takemoto, Y. Inaki and R. M. Otanbrite.
 31. Contemporary Polymer Chemistry, H. R. Alcock and F. W. Lambe, Prentice Hall.
 32. Physics and Chemistry of Polymers, J. M. G. Cowie, Blackie Academic and Professional.

CH-R3 : Seminar on research topic with written report by student

No Credit

Mode of study includes: Assigning the topic to students based on their basic background and presentation in the form of seminar which will be followed by discussion and submission of the write-up. This will be evaluated by group of teachers.

Fwd: Pre Ph D course work modification

From: Dr. Santosh Singh Thakur (santosh.chirality@gmail.com)

To: patragoutam137@gmail.com; patra29in@yahoo.co.in

Date: Thursday, 3 February, 2022 at 12:25 pm IST

----- Forwarded message -----

From: **Dr. Santosh Singh Thakur** <santosh.chirality@gmail.com>

Date: Tue, Jan 11, 2022 at 7:06 PM

Subject: Pre Ph D course work modification

To: P.K. Bajpai <bajpai.pk1@gmail.com>, madhvendra tripathi <ommadhav27@gmail.com>, patragoutam137 <patragoutam137@gmail.com>

Respected Sir,

Kindly find the modified syllabus of Pre Ph.D. course work of common paper 1. The modification is made in accordance with OM no. 786/अ. म./ Forensic/Course/ 2021 dated 17-03-2021 and UGC letter D.O.No.F. I-I 12018(JournaUCARE) December 2019.

Kindly give your valuable inputs, modifications, and approval.

Thanks and regards,

SSthakur

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