**DEPARTMENT OF CHEMISTRY**

**ASSAM UNIVERSITY: SILCHAR**

## Syllabus for IPP Course Work to be effective from 2020 Session

## Course Structure

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Course Number** | **Course Name** | **Nature** | **Max Credit** | **Max Marks** |
|
|
| Paper-501  Paper-502  Paper-503  Paper-504 | Research Methodology  Research Methodology  Advanced Chemical Science  Term Paper | School Level  School Level  Department Level  Department Level | 2  4  4  6 | 50  100  100  150 |
| **Total** | | **16** | **16** | **400** |

# Paper 501 (2 credit) Research and Publication Ethics (RPE)

**UNIT-1 RPE 01: PHILOSOPHY AND ETHICS**

1. Introduction to philosophy: definition, nature and scope.concept, branches
2. Ethics: definition, moralphilosophy, nature of moral judgements and reactions

**UNIT-II RPE 02: SCIENTIFIC CONDUCT**

1. Ethics with respect to science and research
2. Intellectual honesty and research integrity
3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP)
4. Redundant publications: duplicate and overlapping publications, salami slicing
5. Selective reporting and misrepresentation of data

**UNIT-III RPE 03: PUBLICATION ETHICS**

1. Publication ethics: definition, introduction and importance
2. Best practices/standards setting initiatives and guide line: COPE, WAME, etc.
3. Conflicts of interest
4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa types
5. Violation of publication ethics, authorship and contributorship
6. Identification of publication misconduct, complaints and appeals
7. Predatory publishers and journals

**PRACTICE:**

**UNIT-IV RPE 04: OPEN ACCESS PUBLISHING**

1. Open access publications and initiatives
2. SHEPRA/ROMEO online resource to check publisher copyright and self-archiving policies
3. Software tool to identify predatory publications developed by SPPU
4. Journal finder / Journal suggestion tools viz, JANE, Elsevier Journal Finder, Springer Journal suggester, etc.

# UNIT-V RPE 05: PUBLICATION MISCONDUCT

1. Group Discussions
   1. Subject specific ethical issues, FFP, authorship
   2. Conflicts of interest
   3. Complaints and appeals: examples and fraud from India and abroad
2. Software tools

Use of plagiarism software like Turnitin, Urkund and other open source software tools

**UNIT-VI RPE 06: DATA BASES AND RESEARCH METRICS**

1. Databases
   1. Indexing databases
   2. Citation databases: Web of Science, Scopous, etc.
2. Research Metrics
   1. Impact Factor of journal as per Jpurnal Citation Report, SNIP, SJR, IPP, Cite Score
   2. Metrics: h-index, g index, i10 index, altmetrics

**References**

Bird, A. (2006), philosophy of Science, Routledge

MacIntyre, Alasdair (1967) A short History of Ethics, London

P. Chaddah, (2018) Ethics in Competetive Research: Do not get scooped, do not get plagiarized, ISBN:978-9387480865

National Academy of Sciences, National Academy of Engineering and Institute of Medicine. (2009). On Being a Scientist: A Guide to Responsible Conduct in Research: Third Edition, National Academic Press

Resnik, D.B. (2011), What is ethics in research and why is it important, National Institute of Enviromental health Sciences, 1-10, Retrived from <http://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm>

Beall,J.(2012), Predatory publishers are corrupting open access, Nature, 489(7415), 179-179. https://doi.org/10.1038/489179a

Indian national Science Academy (INSA), Ethics in Science Education, Research and Governance (2019), ISBN:978-81-939482-1-1. <http://www.insaindia.res.in/pdf/Ethics_Book.pdf>

# Paper 502 (4 credit)

## UNIT –I:

Research: Meaning, objectives, types, approaches. Criteria of good research, research problems, research design. Review of literature: Meaning, objectives, principles and procedure. Report writing: Meaning, significance, types, techniques, essentials of writing scientific article.

## UNIT – II:

Quantitative methods of research: Methods of data collection – experimental data, field data, data from secondary sources. Relation between variables: correlation (both continuous & binary data), regression (both linear & non-linear) for two variables. Test of significance including one-way- ANOVA. Errors and analysis of errors.

## UNIT – III:

Computer application in research: Data analysis – use of software like Excel/Mat lab/Mathematica/SPSS/R package etc., Word processing – use of software like MS Word/LATEX/End Note etc., Data bases – use of software like MS Access/My SQL etc. Introduction to Computer Network: Network Protocol and topology. Computer simulations: Introduction to mathematical and simulation models, deterministic and stochastic simulation models, continuous and discrete simulation.

## UNIT – IV:

Intellectual Property Rights (IPR) – concept and definition, types - patents, trademarks, copyrights and trade secrets. Salient aspects of :National Science, Technology and Innovation Policy 2013 (STI 2013),National Education policy 2020 (NEP 2020) : introduction (p.1-6), Part-II-Higher Education (p. 33-49), Role of different national level GoI Funding Agency (CSIR, DST, DBT, DAE, DRDO, DOS etc.) for promotion of scientific research.

Suggested readings:

1. Research Methodology-Methods and Techniques, New Age International,

C. R. Kothari, 2nd Ed. (New Delhi), 2008.

1. Research Methodology: A step-by-step guide for beginners, SAGE Publications, Ranjit Kumar, 2005.
2. Mastering MATLAB by Duane C. Hanselman and Bruce L. Littlefield, 2011.
3. Queuing system-vol.2-D, Kleinrock, John Wiley & Sons Inc New York, 1976.
4. Computer Network by A. Tanebaum. Prentice Hall Ind. Englewood cliffs N.J., 1981.
5. Data and computer communications by W. Stallings, Mc Millan Pub. Co. New York, 1976.
6. Document (pdf) on NEP 2020 : https://[www.mhrd.gov.in/sites/upload\_files/mhrd/files/NEP\_Final\_English\_0.pdf](http://www.mhrd.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf)
7. Writing and Presenting Scientific Papers (2nd edition), B. Malmfors, P. Garnsworthy and M. Grossman, Publications from USDA-ARS / UNL Faculty, 2005

**Structure of Paper 503 (Advanced Chemical Science)**

Paper 503 (Advanced Chemical Science) comprises of two parts of equal credit. **Part A** is **compulsory** for all pursuing IPP in Chemistry. The student has to choose any **one group of units** (Group I/II/III) from **Part B**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Paper No.** | **Part** | **Name** | **Nature** | **Credit** | **Marks** |
| Paper-503 | A | Essentials in Chemical Science Research | Compulsory | 2 | 50 |
| B | Group I: Materials Chemistry  Group II: Advanced Organic Chemistry  Group III: Topics in Advanced Chemistry | Optional  (One group of units to be opted) | 2  2  2 | 50  50  50 |
| Total | | | | 4 | 100 |

**Paper-503**

**Advanced Chemical Science**

**Max. Marks: 50+50=100 Credit: 2+2=4**

**This paper comprises of two parts of equal credit. PART A is compulsory for all pursuing IPP in Chemistry. The student has to chose any one Group of units from PART B**

**PART A**

**(Compulsory)**

**Essentials in Chemical Science Research**

**Max. Marks: 50 Credit: 2**

**UNIT-I: Safety Measures and Waste Management in Chemical Laboratory**

Safety measures: Protective gears, laboratory emergencies, Case studies of incidents and Lesson learned , Managing and Working with Chemicals: Chemical Segregation, Transfer and Transport, Chemical Fume Hood, chemical hazards, Use of MSDS, Waste handling: Characterization of Waste, Collection and Storage, Solid Wastes.

**UNIT-II: Instrumental Techniques**

Basic concepts & application related to the following instrumental techniques: FT-IR spectroscopy, Raman spectroscopy, Spectrofluorimetry, GC-MS, Powder XRDMicroscopic Techniques: Polarised Optical microscopy, AFM, SEM, TEM, STM, EDX.FT-NMR: Rules for spectral analysis, 2-D NMR & application of COSY, NOESY, ROESY

**Suggested Readings:**

1. A. Keith Furr, CRC Handbook of Laboratory Safety, 5th Ed., CRC Press. (2000), ISBN 9780849325236.
2. L. Bretherick, Hazards in the chemical laboratory, 4th Ed., Royal Society of Chemistry.
3. Drago, Principles of Instrumental Techniques” H.H.Willard, L.L. Merritt.Jr and J.A.Dean, Instrumental Methods of Analysis, Van Nostrand Company, New York (1965) Revised edition-2008.
4. TensiometryHeideSchatten and J.B.Pawley, Biological “Low Voltage Scanning Electron Microscope” Springer (2007) ,ISBN-10:0387729704.
5. D.C.Bell, Energy Dispersur X –Ray Analysis in the Electron Microscope ,BIOS Scientific Publisher Ltd.(2003).

**PART B**

**(Optional)**

**Any one Group of units from PART B to be opted**

**Group I**

**Materials Chemistry**

**Max. Marks: 50 Credit: 2**

**UNIT-III: Liquid Crystals and Metallomesogens**

Plastic Crystals and Liquid Crystals, Classification, General synthetic strategies of thermotropic liquid crystals, Order parameters for cholesteric, nematic and smectic phase, Optical properties and defects in liquid crystals, Diffraction of X-rays by liquid crystals, Information obtained from X-ray studies on liquid crystalline materials. Electrical and Magnetic properties of liquid crystals,

Definition, examples, strategies for synthesis of metallomesogens, functionalisation of multidentate ligands (salen, salphen type etc.). Metallomesogens involving copper, vanadium, nickel, palladium, platinum, lanthanides etc. Study of their properties, like NLO, photoluminescence etc.

**UNIT-IV: Properties and Applications of Nanoscale Materials**

Nanoscale Materials: Definition, Size and shape effect, Synthesis – Some Typical Chemical approaches Properties – Optical, Electronic, Catalytic and Magnetic, Applications- Solar Cell, Catalysis, and Photodynamic Therapy, Environmental Impacts and Health Hazards

**Suggested Readings**

1. Introduction to Nanoscale Science and Technology, (Ed) M.D.VentraS.Evoy and J.R.Heflen Kluwer Academic Publisher, Boston. , (2004).
2. Nanometerials Chemistry: Resent Developments and New Directions” C.N.R. Rao, A.Muller and A.K.Cheetham, Wiley VCH (2007).
3. Liquid Crystals: Fundamentals, David A. Dunmur and [Shri Singh](http://www.amazon.in/Shri-Singh/e/B001JOER0U/ref=sr_ntt_srch_lnk_3?qid=1487220160&sr=1-3), World Scientific Publishing Co Pte Ltd, 2000.
4. Liquid Crystals, 2nd Ed, S. Chandrasekhar, Cambridge University Press, 1992

# Handbook of Liquid Crystals, Fundamentals, Dietrich Demus, John W. Goodby, George W. Gray, Hans W. Spiess and Volkmar Vill, Wiley, 1998

# Nanoscience with Liquid Crystals,  [Quan Li](http://www.amazon.in/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=Quan+Li&search-alias=stripbooks) (Editor)Springer; 2014 edition

**Group II**

**Advanced Organic Chemistry**

**Max. Marks: 50 Credit: 2**

**UNIT-III: Application of Computer in Chemical Science Research and Organic Photosensitizers.**

Application of computational methods for prediction of chemical Potential, Electronegativity, Hardness and Softness of molecules. DFT Formulation of Reactivity—The Fukui Function. Electronic structure and thermochemical properties, geometry optimization, study of reaction mechanism, transition-state optimizations.

Biomedical Organic Photosensitizers: Porphyrin analogues, nucleic acid analogues, functionalization of carbon nanomaterials with organic molecules in the development of photosensitizers. Photodynamic therapy and applications, Photo thermal therapy, Hyperthermia.

**UNIT-IV: Organic Reaction Methodology**

Designing organic synthesis, Multi-component reactions for the synthesis of heterocyclic and biologically active molecules, Ugi Reaction, Passerini Reaction, Heterogeneous catalysis, Organocatalysis, Glycosylation techniques.

**Suggested Readings**

1. Organic Synthesis with Carbohydrates, Geert-Jan Boons, Continuum International Publishing Group - Sheffie
2. Carbohydrate Chemistry, Geert-Jan Boons, Springer
3. Computational Chemistry : Intro To The Theory & Applications Of Molecular & Quantum Mechanics,  Errol Lewars, Springer
4. Computational Chemistry (Oxford Chemistry Primers), Guy H. Grant, OUP Oxford
5. Photosensitizers in Medicine, Environment, and Security,T. Nyokong (Editor), Vefa Ahsen (Editor), Springer
6. Towards Dual and Targeted Cancer Therapy with Novel Phthalocyanine-based Photosensitizers, Janet T F Lau, Springer
7. Designing Organic Synthesis, Sharma, Pragati Prakashan
8. Designing Organic Syntheses: A Programmed Introduction to the Synthon Approach, Stuart Warren, Wiley-Blackwell
9. Multicomponent Reactions: Concepts and Applications for Design and Synthesis, Raquel P. Herrera, Eugenia Marqués, Wiley-VCH, Weinheim, 2015

**Group III**

**Topics in Advanced Chemistry**

**Max. Marks: 50 Credit: 2**

**UNIT-III: Application of Transition Metal Complexes and application of Fluorescence.**

Binding of transition metal complexes with DNA and Nucleic Acid, Alkaline phosphatase: structure and reactivity; Insulin: structure and reactivity.

Types of Photophysical Pathways, Fluorophores, Quenching of Fluorescence, Energy Transfer and Protein Fluorescence.

**UNIT-IV: Chemical and Electrochemical Kinetics and Environment Related Chemistry**

Electrochemistry Fuel cells; Solar cells (photochemical, photovoltaic); Batteries (solid-state & conventional)-single electrode and complete cell studies; Production of H2 and important chemicals of high energy; Corrosion & waste removal techniques

**Suggested Readings**

1. Shriver& Atkins’ Inorganic Chemistry, P. Atkins, T. Overton, J. Rourke, M. Weller, F. Armstrong, Fifth Edition, Oxford University Press.
2. Protein Fluorescence,  Joseph R. Lacowicz, Springer
3. Single-Molecule Fluorescence Spectroscopy of the Folding of a Repeat Protein,  Sharona Cohen, Springer

**Paper-504**

**Term Paper**

**Max. Marks: 150 Credit: 6**

A prospective Ph. D scholar shall prepare a term paper (not exceeding 10-15 pages) which will involve both a report as well as a presentation on the subject area of his/her Ph.D topic including objectives /literature review, etc. This term paper shall be guided by the supervisor.