MJPRU/FET/CY 1452/11/01/2023

M.J.P. ROHILKHAND UNIVERSITY

एम.जे.पी.
रुहेलखण्ड विश्वविद्यालय बरेली

SYLLABUS FOR THE Ph.D. COURSE WORK

SUBJECT: CHEMISTRY

CHOICE BASED CREDIT SYSTEM (CBCS)

EFFECTIVE FROM

THE ACADEMIC YEAR 2022-23

SCHEME OF PRE-Ph.D. COURSE WORK

The details of course work is given in following table:

PART-A		PART-B
Paper-I (PHDCY-701) **Credit:** 04	**Paper-II (PHDCY-702)** **Credit:** 04	**Paper-III (PHDCY-703)** **Credit:** 04
Research Methodology & Research Publication Ethics (as per UGC guidelines).	Subject covering candidate's/supervisor's/ department's chosen research area topics. Or Online Courses: (NPTEL/SWAYAM).	Literature Survey Report (LSR): In this course, the student has to carry out extensive literature survey in the chosen field of research and prepare a literature survey report (LSR).
Maximum Marks: 100	**Maximum Marks:** 100	**Maximum Marks:** 50

DEPARTMENT OF APPLIED CHEMISTRY

SYLLABUS OF THE PRE-Ph.D. COURSE WORK

Paper-I (PHDCY-701): Research Methodology & Research Publication Ethics
Credit: 04

Part-I: Research Methodology		
Unit	**Title**	**Topics**
1.	**Fundamentals of Research and Types of Research**	Research Objectives, Scientific Research, Importance of Research Methodology, Good Research Practices (GRP), Types of Research and Methods, Surveys, Case Studies, Experiments and Field Studies etc.
2.	**Literature Review in Research**	Basic Concept and its Need, Literature Search, Types of Literature Review, Review of Research, Sources, Synthesis Process, Planning of Review and Documentation.
3.	**Research Design**	Process, Identification and Formulation of Problem, Hypothesis, Tools of Research.
4.	**Data Analysis & Interpretation**	Editing, Coding, Transcription, Tabulation, Introduction to Analytical/Statistical Software (SPSS or MINITAB or MATLAB) and Presentation of Data (Graphical).
5.	**Statistical Analysis and Report Writing**	Measures of Central Tendency, Dispersion and Association/Relationship, Variance, Regression and Correlation Analysis, Hypothesis Testing and Test of Significance, Research Paper and Thesis Writing.
Part-II: Research Publication Ethics		
1.	**Research Ethics and Scientific Conduct**	Introduction to Research Philosophy and Concept of Research Ethics, Ethical Aspects in Science and Research, Intellectual Honesty, Research Integrity, Scientific Misconducts (Falsification, Fabrication, Plagiarism), Redundant Publications (Duplicate, Overlapping and Salami Slicing), Selective Reporting and Misrepresentation of Data.

2.	**Publication Ethics**	Concept of Publication Ethics and its Significance, Best Practices and Guidelines (COPE, WAME, etc.), Conflict of Interest, Publication Misconduct: Concept, Problems and Types, Violation of Publication Ethics, Authorship and Contributor-Ship, Identification of Publication Misconduct, Complaints and Appeals.
3.	**Predatory and Open Access Publication**	Predatory Publishers and Journals, Open Access Movement and Publications, SHERPA/RoMEO Tools to Check Copyright and Self-Archiving Policies, Journal Finder/Journal Suggestion Tools (JANE, EJF, SJS), Group Discussion on Publication Misconduct.
4.	**Quality Parameters and Practices**	Copy Rights and Intellectual Property Rights (IPR), Plagiarism Check: Software Tools (TURNITIN, URKUND, etc.), Practice Databases (Indexing, Citation) and Research Metrics: *h*-index, *g*-index, *i*-10 index, Impact Factor, SNIP, SJR, IPP, Cite Score *etc.*

References:

1. Kothari, C.R. (2014) *Research Methodology: Methods and Techniques*, 2nd ed., New Age International Publishers, New Delhi.
2. Best, J.W. and Kahn, J.V. (2006) *Research in Education*, 10th ed., Pearson Publication, New Delhi.
3. Koul, L. (2019) *Methodology of Educational Research*, 5th ed., Vikas Publ., New Delhi (ISBN-9789353386368).
4. Garrett, H.E. (2005) *Statistics in Psychology and Education*, Paragon International Publishers, New Delhi.
5. Kambadur, M. Ghosh A. and Singhvi A.K. (2019) *Ethics in Science Education, Research and Governance*, Indian National Science Academy, New Delhi (ISBN:978-81-939482-1-7).
6. Best Practice Guidelines on Publishing Ethics (2014), A Publisher's Perspective, 2nd ed., John Wiley & Sons, Ltd.
7. Chaddah, P. (2018) *Ethics in Competitive Research*: *Do not get Scooped*; *Do not get Plagiarized* (ISBN-978-9387480865).
8. National Academy of Sciences, National Academy of Engineering and Institute of Medicine (2009) *On Being a Scientist*: *A Guide to Responsible Conduct in Research*, 3rd ed., National Academies Press.
9. Beall, J. (2012) *Predatory Publishers Corrupting Open Access*, Nature, 489 (7415):179.
10. Bird A. (2006) *Philosophy of Science*, Routledge.
11. Software Manual SPSS/MINITAB/MATLAB.
12. UGC syllabus for Research and Publication Ethics, D.O. no. F.1-1/2018(Journal/CARE), Dec. 2019.

Paper II (PHDCY-702): Advanced Chemistry
Credit: 04

Unit	Title	Topics
1.	**Different Chromatographic Techniques**	Chromatography Terms, Techniques by Chromatographic Bed Shape, Column Chromatography, Planar Chromatography, Paper Chromatography, Thin Layer Chromatography, Displacement Chromatography, Techniques by Physical State of Mobile Phase, Gas Chromatography, Liquid Chromatography, Affinity Chromatography, Supercritical Fluid Chromatography, Techniques by Separation Mechanism, Ion Exchange Chromatography, Size-Exclusion Chromatography, Expanded Bed Adsorption (EBA) Chromatographic Separation, Special Techniques, Reversed-Phase Chromatography, Two-Dimensional Chromatography, Simulated Moving-Bed Chromatography, Pyrolysis Gas Chromatography, Fast Protein Liquid Chromatography, Countercurrent Chromatography and Chiral Chromatography.
2.	**Computer Programming for Chemists**	Basics of Computer Operating System: Using Windows-Directory Structures-Command Structure (Document Preparation, EXCEL, Power Point Presentation); Word Processing: Basics of Editing and Word Processing; Numerical Plotting: Figure Insertions in Documents; Web Browsing for Research: Usage of Webs as a Tool for Scientific Literature Survey; Error Analysis: Basics of a Measurement and its Interpretation, Mean, Standard Deviation, Variance, Correlation Coefficient, Usage of Packages (E.G. ORIGIN, EXCEL) for Data Analysis: Curve Fitting: Linear and Non Linear Fitting of Data.
3.	**Basics of NMR and Mass Spectroscopy**	Basics of NMR Techniques, Chemical Shift, *J*-Coupling, Second-Order (or Strong) Coupling, Magnetic Inequivalence, Deuterated Solvents, Correlation Spectroscopy, Biomolecular NMR Spectroscopy, Proteins, Nucleic Acids, Carbohydrates Basics of Mass Spectroscopy; X-Axis: *M/Z* (Mass-to-Charge Ratio), Alternative X-Axis Notations, History of X-Axis Notation; 2 Y-Axis: Signal Intensity, Y-Axis and Relative Abundance.
4.	**Synthetic Organic**	Heterocyclic Compounds of Therapeutic Value, Phenothiazine and Sulpha Drugs, Some Aspects of the Chemistry of

	Chemistry	Cycloalkanes with Particular Reference to their Synthesis and Properties, Carcinogens.
5.	**Organic Named Reactions**	Arbuzov Reaction, Bamford-Stephens Reaction, Barton Olefin Synthesis, Baylis-Hillman Reaction, Barton Reaction, Bergman Reaction, Biginelli Reaction, Corey-Kim Oxidation, Mitsunobu Reaction, Jones Oxidation, Jacobsen Epoxidation, Fischer Oxazole Synthesis, Fischer Indole Synthesis, Sharpless Epoxidation, Simmons-Smith Reaction, Swern Oxidation, Nerf Reaction, Grubbs Reaction, Danishefsky's Diene Reaction, Dess-Martin Oxidation Reagent and Recent Organic Name Reactions.
6.	**Chemistry of Macromolecules**	Functionality of Monomers, Degree of Polymerization, Types of Polymerization, Addition, Condensation and Co-Polymerization, Glass Transition Temperature (Tg), Number Average, Weight Average and Viscosity Average Molecular Weight of Polymers.
7.	**Bioinorganic Chemistry**	Fundamentals of Bioinorganic Chemistry, Elements in Body, Geo-Chemical Effects on Distribution of Metals, Metal Ions in Biological System and their Classification as Trace, Toxic, Essential and Non-Essential, Metal Ions in their Excess and Deficiency, Toxic Metal Ions, Fundamentals of Toxicity and Detoxification or Chelation Therapy, Designing of Chelating Agents and Metal Chelates as Medicines, Coordination Compounds in Medicine, Metal Complexes and their Interaction with Nucleic Acids, Role of Alkali/Alkaline Earth Metals in Bio-Systems, Role of Metal Ions in Replication and Transcription Process of Nucleic Acids, Synthetic and Natural Oxygen Carriers and their Mechanism, Non-Heme Iron-Sulfur Proteins, Fixation of Dinitrogen Biologically and a Biologically, Metal Ions as Probes for Locating Active Sites, Anti-Oxidants, Role of Metal Ions in Antioxidants, Metal Ion Enhancing Catalytic Activity of Enzymes (Biocatalysts), Metals in the Regulation of Biochemical Events, Transport and Storage of Metal Ions *In Vivo*, Metal Complexes as Probes and Chemotherapeutic Application of Metal Complexes-A General Survey.

References:

1. F. W. Billmayer, Jr., T*ext Book of Polymer Science*, Wiley-Interscience, New York.
2. P. K. Sinha, *Computer Fundamentals*.
3. J. E. Huheey, E. A. Keiter and R. L.Keiter, *Inorganic Chemistry*, 4th ed., Pearson, 2001.

4. G. L. Miessler and D. A. Tarr, *Inorganic Chemistry*, 3th ed., Pearson, 2004.
5. D. F. Shriver, P. W. Atkins, T. L. Overton, J. P. Rourke, M. T. Weller and F. A. Armstrong, *Inorganic Chemistry*, 4th ed., Oxford University Press, 2006.
6. J. D. Lee, *Concise Inorganic Chemistry*, 5th ed., Wiley, 2010.
7. S. Cotton, *Lanthanide and Actinide Chemistry*, Wiley & Sons Ltd, 2006.
8. W. U. Malik, G. D. Tuli and R. D. Madan, *Selected Topics in Inorganic Chemistry*, S. Chand, 2019.
9. P. Sykes, *Mechanism in Organic Chemistry*.
10. J. March, *Advanced Organic Chemistry*, Wiley.
11. House, *Synthetic Reactions*.
12. R. T. Morrison & R. N. Boyd, *Organic Chemistry*, P.H. Ltd.
13. Fieser & Fieser, *Topics in Organic Chemistry*, Reinhold.
14. I. L. Finar, *Organic Chemistry* (vol. 1 & 2), Elbs & Longmann.
15. S. J. Lippard, J.M. Berg, *Principles of Bioinorganic Chemistry*, University of Science Books.
16. W. Kemp, *Organic Spectroscopy*, 3rd ed., Palgrave, 2012.
17. D. L. Pavia, G.M. Lampman, G. S. Kriz and J.R. Vyvyan, *Introduction to Spectroscopy*, 5th ed., Cengage Learning, 2015.
18. R. M. Silverstein and F. X. Webster, *Spectrometric Identification of Organic* Compounds, 6th ed., Wiley, 2010.
19. D. H. Williams and I. Flemming, *Spectroscopic Methods in Organic Chemistry*, 6th ed., McGraw-Hill, 2011.
20. D. N. Sathyanarayana, *Handbook of Molecular Spectroscopy: from radio waves to gamma rays*, 2nd ed., Wiley, 2019.
21. C. N. Banwell & E. M. McCash, *Fundamental of Molecular Spectroscopy*, 4th ed., McGraw-Hill, 2017.
22. D. A. Williams & T. L. Lemke, Foye's *Principles of Medicinal Chemistry*.
23. Wilson & Gisvold's *Text Book of Organic, Medicinal & Pharmaceutical Chemistry*.

Online Courses (Optional)

Online courses/topics may be included as per the requirement. The students may opt any of the ***available online course*/topics** from the links given below:

1. https://swayam.gov.in/explorer?category=Chemistry
2. https://archive.nptel.ac.in/noc/courses/104/

Paper III (PHDCY-703): Literature Survey Report (LSR) **Credit:** 04	
Title	**Topics**
Literature Survey Report (LSR)	In this paper the candidates shall be required to carry out exhaustive literature survey and prepare a review covering a literature survey of last 10 years in the area specific to the candidate's/supervisor's chosen research area and the prepared review has to be submitted to the DoR with a copy to Head of the Department. The literature review project has to be checked for plagiarism and should be in compliance with the plagiarism policy of the university. The evaluation of this paper will be done at department level by the approved external expert. The format for the LSR will be the same as that of synopsis format.