

Department of Chemistry
Prof. Rajendra Singh (Rajju Bhaiya) Institute of Physical Sciences for
Study and Research
V. B. S. Purvanchal University, Jaunpur

Pre- Ph.D. Course Work
(Ordinance and Syllabus w.e.f. 2022-23)

Aim of the Course Work: The Pre- Ph.D. course work is designed to develop investigative, evaluative, comprehensive, reasoning, statistical analyses and writing skills in students to create an in depth understanding of his/her area of research.

Programme outcome:

Students will have a strong foundation in the fundamental and applications of several topics of the chemistry. Students will be able to learn all spectroscopic techniques and interpret the spectral data of chemical compounds. The students will be able to explore the concept of research, research tools and different types of research.

Course outcome:

After the completion of this course, the research students gain the knowledge of types of research, research tools and methodology. This course helps to understand the separation and purification techniques, different spectroscopic techniques and computational software and computer used to establish the structure of the chemical compounds.

General Instructions:

1. All matters relating to admission to this course shall be dealt by the Ph.D. Admission Committee constituted for the purpose by the University.
2. As per the university ordinance, the research scholars who are provisionally registered for the Ph.D. programme will undergo a pre-Ph.D. Course work which is mandatory for all.
3. In pre-Ph.D. Course work, the Ph.D. candidate has to pass three compulsory theory papers of total 16 credits that comprises two main papers from the subject (6 + 6 credits) in which the candidate has taken admission and one paper on Research Methodology (that includes topics on research ethics, plagiarism and computer applications) (4 credits).
4. For successful completion of the course work, the Ph.D. candidate is also required to complete one research project in addition to the three compulsory papers.
5. The duration of Pre-Ph. D. course work with three compulsory papers and one project will be of one semester (six month).
6. Normally examinations will be held two times in a year and will be notified by the Head of the Department. Every student will be required to fill up the examination form within the stipulated time notified by the Head of the Department.

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7. The Ph.D. candidate has to obtain a minimum of 55% marks or equivalent Grades/CGPA in aggregate during the course work in order to be eligible to continue in the Ph.D. programme and submit the thesis.
8. The name of the candidates successful in the semester system in Pre- Ph.D. Course in Chemistry examination shall be arranged in the following grade system:

लेटर ग्रेड	विवरण	अंको की सीमा	ग्रेड पॉइंट
O	Outstanding	91-100	10
A ⁺	Excellent	81-90	9
A	Very good	71-80	8
B ⁺	Good	61-70	7
B	Pass	55-60	6
F	Fail	0-54	0
AB	Absent	Absent	0
Q	Qualified		
NQ	Not Qualified		

9. The minimum attendance required during the course work period is 75% of the total courses.

Scheme of the Course (All papers are compulsory)

Paper	Title	Credits
I	Analytical Tools and Instrumentation	6
II	Advance Organic Chemistry	6
III	Research Methodology in Chemistry	4

Paper Setting and Evaluation Pattern (For Paper I, II and III)

Types of Question	Total Number of Questions	Questions to be attempted	Marks	Time
Objective Type	10	10	10x2=20	3 Hours
Short Type	8	5	5x8=40	
Long type	4	2	2x20=40	

Total Marks: 100

Note: As Per UP government direction teachers in service are allowed to attend their Pre-Ph.D.- Course Work class either in online or in offline mode.

Syllabus

Programme/Class: Pre-Ph.D. Course work	Year: Sixth	Semester: Eleventh
Subject: Chemistry		
Course Code: B021101T	Course Title: Analytical Tools and Instrumentation	
Credits: 6		
Max. Marks: 100	Min. Passing Marks: 55	

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Unit	Topics
I	Thermal methods: Principle, instrumentation and applications of DTG, DTA, TMA, DSC. Principle and applications of photometric and colorimetric techniques in inorganic analysis.
II	X-ray methods: Principle, instrumentation and applications of (XRD, XRF, SAXS). Example will be taken from real research related problem
III	Principle, instrumentation and applications of NMR (^1H , ^{13}C) and other Spectroscopic methods (EPR, Raman, IR, UV, Fluorescence). Example will be taken from real research related problem.
IV	Purification Techniques: A brief knowledge about various techniques such as distillation, fractional distillation, crystallization, fractional crystallization. Chromatography: i. Column, ii. TLC, iii. Paper, iv. Gas Chromatography, v. Ion Exchange, vi. HPLC, vii. Gel Permeation
V	Electron Microscopy (SEM, TEM): Principle, instrumentation and applications, Imaging and Introduction to Interpretation, Image Interpretation and Artifacts, Electron Tomography, Electron Probe Micro Analysis (EDS, WDS): Principle, instrumentation and applications, Quantitative Analysis (AAS, ICP, CHN): Principle, instrumentation and applications

Suggested Readings:

1. Fundamentals of Analytical Chemistry: D.A. Skoog, D.M. West and F.J. Holler, 1992, 6e
2. Analytical Chemistry, Gary D. Christian, 2007, 6e
3. Instrumental Methods of Analysis: H.H. Willard, L.L. Merrit, Jr. J.A. Dean, 1974, 5e
4. Hobert H. Willard, D. L. Merrit & J. R. J. A. Dean, Instrumental methods of analysis, C.B.S Publishers and Distributors, 1992.
5. Ewing, Instrumental Methods of Analysis, 1992.
6. Physical Principles of TEM, Ray F. Egerton. "Physical Principles of Electron Microscopy An Introduction to TEM, SEM, and AEM (2005) Springer, New York, URL: <https://link.springer.com/book/10.1007%2Fb136495>
7. Material Sciences, D. B. Williams and C. B. Carter, "Transmission Electron Microscopy: A Textbook for Material Scientists, 2nd edition" (2009) Springer, URL: <http://link.springer.com/book/10.1007%2F978-0-387-76501-3>

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Programme/Class: Pre-Ph.D. Course work	Year: Sixth	Semester: Eleventh
Subject: Chemistry		
Course Code: B021102T	Course Title: Advance Organic Chemistry	
Credits: 6		
Max. Marks: 100		Min. Passing Marks: 40
Unit	Topics	
I	Materials, Catalyses and Electrochemical Studies Magnetic properties of Materials; Optical properties of Materials; Homogeneous and Heterogeneous catalysis; Sensor; Cations and anions; Thin film semiconductors: synthesis and its application.	
II	Surface Chemistry: Preparation, Characterization and Application of nanoparticles, Metal Organic Framework (MOF),	
III	Advanced Organic Synthesis: Application of photochemistry and radical chemistry in Organic Synthesis; Total synthesis of natural product, Asymmetric Synthesis.	
IV	Supramolecular Chemistry and DFT Computation: Supramolecular Chemistry; DFT computation (different software and related molecule to solid materials).	
V	Smart material and solar cell: 0D, 1D and 2D material, Dye and pervoskite Solar cells (photochemical, photovoltaic) fabrication.	
Suggested Readings: 1. Organic Spectroscopy, William Kemp, English Language Book society, Macmillan, 1987. 2. Application of Absorption Spectroscopy of Organic Compounds, John R. Dyer, Prentice Hall of India Private Ltd., New Delhi, 1974. 3. Spectrometric Identification of Organic Compounds, 4th edition, Robert M. Silverstein, G. Clayton Bassler and Terence C. Morrill, John Wiley & Sons, New York, 1981. 4. An Introduction to Practical Organic Chemistry – Robert, Vingrove etc. 5. Fundamentals of Analytical Chemistry, Skoog, West, Hollar and Crouch, 8th Ed. 6. Modern Analytical Chemistry by David Harvey, 3 rd Ed. 7. K. Albert, L. Lehninger, D.L. Nelson, M.M. Cox, Principles of Biochemistry, CBZ publishers, 1st edition, New Delhi, 1993. 8. Encyclopedia of Chemical Technology – Kirck-Othmer series. 9. Inorganic Chemistry (4 th edition): J.E. Huheey, E.A. Keiter and R.L. Keiter. 10. Advanced Inorganic Chemistry (5 th edition): F.A. Cotton and G. Wilkinson: Wiley 11. An Introduction to X-ray Crystallography, Michael M. Woolfson 12. Crystal Structure Determination, Werner Massa & Robert O. Gould 13. Introduction to Electrochemistry by S. Glasstone.		

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Programme/Class: Pre-Ph.D. Course work		Year: Sixth	Semester: Eleventh
Subject: Chemistry			
Course Code: B091103T		Course Title: Research Methodology in Chemistry	
Credits: 4			
Max. Marks: 100		Min. Passing Marks: 40	
Unit	Topics		
I	Introduction of Research Methodology: Meaning of research, objectives of research, types of research, significance of research, problems encountered by researchers in India. Research Problem: Definition, necessity and techniques of defining research problem, Formulation of research problem, Objectives of research problem. Research Design: Meaning, need and features of good research design, Types of Research Designs, Basic Principles of Experimental Designs, Design of experiments, Synopsis design for research topic.		
II	Ethical issues in science research and reporting: objectivity and integrity, the problem of plagiarism and related issues, international norms and standards, Scientific temper and virtues; expectations from scientific community, Desired temper of scientists: truthfulness, simplicity, humility, open mindedness; attitude of service towards social and human well-being.		
III	Nature and importance of Communication in Science, Preparation of manuscripts: review articles, research papers, books, monographs, research projects; review of manuscripts, Survey of literature, and presentation of data, Popularization of Science. Socio – Legal issues: Originality, Integrity, IPR, Patents, Plagiarism.		
IV	Computer application in chemistry, study of different software's (MS-Excel, MS office, Power Point, Chemdraw, GaussView). Introduction to Networking and Search using Internet, online submission, e-submission etc.		
V	Paper/Thesis Writing and Report Generation: Basic concepts of paper their writing and report generation, review of literature, Concepts of Bibliography and References, significance of report writing, steps of report writing, Types of Research reports, Methods of presentation of report.		
Suggested Readings: <ol style="list-style-type: none"> 1. Good Laboratory Practice. http://en.wikipedia.org/wiki/Good_Laboratory_Practice 2. What is scientific method? http://www.experiment-resources.com/ 3. Research methodology resources. http://edutechwiki.unige.ch/en/Research_methodology_resources 4. Overview of research methods. www.answer.com/ topic/ overview - of - research - methods. 5. David B. Resnik, 1998, The Ethics of Science: An Introduction. Routledge publisher, USA. 6. Callahan D. & Bok S., 1996, Ethics Teaching in Higher Education. Plenum Press, New York, USA. 7. Kapur J.N., 1996, Ethical Values for Excellence in Education and Science, Vishwa Prakashan, New Delhi. 8. Tripathi A.N., 2008, Human Values. New Age International Publishers, New Delhi. 9. Wilson: Handbook of Science Communication, 1998, Institute of Physics Publishing, Bristol, Philadelphia. 10. Science Communication: Theory & Practice; Stocklmayer, Gore MM, Bryant C (Eds.), 2002, Springer. 11. Laszlis P: Communicating Science: A practical Guide, 2006, Springer. 			

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