



Veer Bahadur Singh Purvanchal University, Jaunpur U.P.

Template for designing the Syllabus of Pre-Ph.D. course work

As per NEP-2020 guidelines

With effect from academic session 2022-23

Subject prerequisites: To study the subject: **CHEMISTRY**

Programme outcomes (POs):

After completing this Course, the scholars shall be able to:

- PO1: Successfully use the different methodologies of research.
- PO2: Understand and avoid plagiarism and other academic malpractices and present their research.
- PO3: Enhance the skills of computer application in carrying out the research work.
- PO4: Expands the knowledge in their research area, including its theoretical foundation and specific techniques used to study it.
- PO5: Follow the principles of ethics in their field and in their academia.

Programme specific outcomes (PSOs):.....

- PSO1: Read, analyse and comprehend the basic and advanced rules of research methodology.
- PSO2: Apply the knowledge of research documentation for communicating and presenting the findings.
- PSO3: Minimize the risk of injury in doing work in laboratory and they have training, information support and equipment needed to work safely in the laboratory.
- PSO4: Have understanding of different purification criteria of separation and be able to account for fundamental separation processes and their connection to molecular properties.
- PSO5: IUPAC awareness on the world authority on chemical nomenclature terminology standardized methods of measurement.
- PSO6: Characterize the structure of the compound using techniques like UV-VIS, IR, NMR & MS.
- PSO7: Provide sufficient knowledge and their interest in inorganic, organic and physical chemistry.

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List of all papers of Pre-Ph.D. course work or Post graduate diploma in Research (PGDR)

Year	Sem	Course Code	Course Title	Theory/ Research	Credit	Max. Marks
6	XI	B021101T	Paper 1: Techniques used in Chemistry	Theory	6	100 [25(CIE)+75(UE)]
		B021102T	Paper 2: Chemistry	Theory	6	100 [25(CIE)+75(UE)]
		B021103T	Paper 3: Research Methodology, Research Publication Ethics and Computer Applications	Theory	4	100 [25(CIE)+75(UE)]
		B021104T	Paper 4: Research Project	Research	-	100 [25(CIE)+75(UE)]

Credit system:

- A four (4) credit theory course/paper will have four Lectures/periods (of one hour) in a week. In one full semester the course will be covered in 60 Lectures.
- Similarly, a six (6) credit theory course/paper will have six Lectures/periods (of one hour) in a week. In one full semester the course will be covered in 90 Lectures.

Continuous Internal Evaluation (CIE) of 25 marks:

- Continuous internal evaluation will be performed by the teacher/ course coordinator concerned.
- CIE shall be 25% of total assessment in a Theory paper and research project.
- 25 marks shall be distributed as 5 marks for attendance, 5 marks for presentation and assignment and remaining 15 marks for class test.

Marking system:

- All papers will have a total maximum mark of 100, including both CIE and University Examination (UE). Maximum marks of 25 will be allotted to CIE and 75 to UE in a theory paper/ research project.
- The CIE of the research project shall be evaluated by the research supervisor and co-supervisor (if any).
- 75 marks of **research project** shall be distributed as 50 marks (project work and presentation) and a viva voce of 25 marks.
- The evaluation (Max Marks 75 UE) of the research project shall be done by internal examiner/s (Supervisor and Co-supervisor (if any)) and one external examiner appointed by the University.

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Research Project Submission:

- The evaluated research project report in two sets of hard copy (spiral binding) must be prepared. One copy of it shall be submitted to the university if it demands. A second copy of the evaluated research project report must be in the records of the college/research centre.
- The format of university Ph.D. thesis writing guidelines can be used as format of Research project writing guidelines.

Programme: Post Graduate Diploma in Research(PGDR)		Year: Six(6)	Semester: XI
Subject: CHEMISTRY			
Course Code: -B021101T		Course Title: Paper 1: Techniques used in Chemistry	
Course Outcomes: After completing this course, the scholars shall be able to: CO1: Understanding of different criteria of separation and be able to account for fundamental separation processes and their connection to molecular properties. CO2: Understanding the knowledge of purification of compounds by distillation, crystallization and chromatographic technique. CO3: Gain knowledge of analytical application by using UV-VIS, IR, NMR and MS technique. CO4: Learn the basic theory of x-ray diffraction methods, microscopic methods mechanical properties and electrical properties.			
Credits: 06		Paper: Core Compulsory	
Max. Marks: 25(CIE)+75(UE)		Min. Pass Marks: 55	
Total No. of Lectures: Lecture-Tutorials-Practical (6 hours in a week) L-T-P: 6-0-0: 90 Hours			
Unit	Topic	No. of Lecture- Hours	
I	Basic theory , Melting point and Boiling point determination, Fractional distillation, Purification of compounds by crystallization, Chromatography.	15	
II	Purification of solvents, evaporation of solvent-Steam distillation, solvent extraction, sublimation. Determination of percentage of C, H, N & S.	15	
III	Instrumentation and analytical applications of the following physical methods: spectroscopic [NMR, ESR, MS(EI, FAB).	15	

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IV	Applications of the following physical methods: IR UV-VIS, and Atomic absorption], GC-MS, LPLC, Membrane processes and Gel Filtration.	18
V	Basic theory, instrumentation and analytical applications of the following physical methods: X-ray diffraction methods (powder method), Microscopic methods (Polarized optical microscope).	15
VI	Basic theory, instrumentation and analytical applications of the following physical methods: SEM, TEM, AFM), Mechanical Properties (DMA), Rheological properties (Viscometer, Rheometer), Electrical properties (Conductivity).	12

Suggested Readings:

- R.M. Silverstein and F.X. Webster, Spectroscopic identification of organic compound, John Wiley, New York
- J.R. Dyer, Application of Absorption Spectroscopy of Organic Compounds, Prentice Hall, New Delhi.
- J.M. Hollas, Modern Spectroscopy, John Wiley and sons, Chichester.
- C.N. Banwell and E.M. Mc Cash, Fundamentals of Molecular Spectroscopy, Tata Mc Graw Hill, New Delhi.
- R.S. Drago, Physical Methods in Chemistry, International, Allahabad East West Press, New Delhi.
- D.A. Skoog, F.J. Holler and T.A. Nieman, Principles of Instrumental Analysis, Harcourt Brace & Company, Florida.
- <https://www.en.wikipedia.org>

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on Project/Assignment and Internal Class Test. The marks shall be as follows:

Project/Assignment	10 Marks
Internal Class test	15 Marks
Course prerequisites:	To study this course, a student must have passed Master's Degree in Chemistry

Programme: Post Graduate Diploma in Research(PGDR)	Year: SIX(6)	Semester: XI
Subject: CHEMISTRY		
Course Code: -B021102T	Course Title: Paper 2: Chemistry	
<p>Course Outcomes:</p> <p>After completing this course, the scholars shall be able to:</p> <p>CO1: Focus on the synthesis and characterisation of coordination compounds with their application.</p> <p>CO2: Provide background and sufficient knowledge and their interest in bioinorganic chemistry, coordination chemistry, organic chemistry and physical chemistry.</p> <p>CO3: Focus on reactivity and synthesis in organic chemistry, application on the concept of green chemistry in organic synthesis.</p> <p>CO4: Learn about reaction of chemical kinetics and thermodynamic investigation.</p>		

Credits: 06		Paper: Core Compulsory
Max. Marks: 25(CIE)+75(UE)		Min. Pass Marks: 55
Total No. of Lectures: Lecture-Tutorials-Practical (6 hours in a week) L-T-P: 6-0-0: 90 Hours		
Unit	Topic	No. of Lecture-Hours
I	Section A: Inorganic Chemistry 1. Synthesis and characterization of coordination compounds and their applications. 2. Biological significance of metal ions: Fe, Zn, Mn, Co, Ni. 3. Transition metal storage, transport and biomineralization. 4. Metal containing electron transfer proteins. a. Iron-Sulfur proteins-Rubredoxins, Ferredoxins and Rieskeproteins. b. Blue copper protein c. Cytochromes	20
II	Section B: Organic Chemistry 1. Organic Synthesis: Synthesis of pyrazole, imidazole, thiazole, indole, oxazole containing heterocyclic derivatives & their biological applications. 2. Organic Solvents: Environmentally benign solvents, Solvent free synthesis, Water as a reaction solvent, ionic liquids. 3. Phase Transfer catalysis: Definition, Mechanism, Types of phase transfer catalyst, Synthesis and synthetic applications.	20
III	Section C: Physical Chemistry Chemical Kinetics of reactions and thermodynamic investigations: Methods of determination of order of reaction, factors affecting the rate of reaction, effect of temperature on reaction rate and energy of reaction, collision theory, absolute reaction rate (Transition State theory), Unimolecular, bimolecular and termolecular reactions, kinetic isotope effect, primary, primary and secondary sun effect in the light of mechanistic test, theory of absolute reaction between atoms and reactions between molecule in terms of partition function, effluence of ionic strength, dielectric constant, acid-base catalysis. Reaction Mechanism involving such as Ce(IV), $K_3Fe(CN)_6$]N-Bromosuccinimide N-Bromoacetamide, N-Cholorosuccinamide, Chloramine-T, Bromamine-B, $KBrO_3$, KIO_3 and $NaIO_4$ in the presence of transition metal ions as homogeneous catalyst in alkaline or acidic medium. Application of spectrography in elucidation of reaction mechanism and rate law.	20
Suggested Readings: <ul style="list-style-type: none"> M.N. Hughes, Inorganic Chemistry of Biological Processes, 2nd Ed. (1981), John-Wiley & Sons, New York. W. Kaim and B. Schwederski, Bioinorganic Chemistry Inorganic elements in the chemistry of life, an introduction and Guide, Wiley, New York (1985). S.J. Lippard and J.M. Berg, Principles of Bioinorganic Chemistry, University Science Book. M.B. Smith & Jerry March, Advanced Organic Chemistry, John Wiley & Sons, New York. J. Clayden, N. Greeves, S. Warren and P. Wothers, Organic Chemistry, Oxford University Press. IND, New York. 		

- K.J. Laidler, Chemical Kinetics, Mc-Graw Hill
- James H. Chemical Kinetics and Reaction Mechanism, Espenson, Graw Hill International Edition).
- Vogel's, Textbook of quantitative chemical analysis.
- Peter Atkins, Physical Chemistry.
- <https://chem.libretexts.org>
- <https://britannica.com>

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on Project/Assignment and Internal Class Test. The marks shall be as follows:

Project/Assignment	10 Marks
Internal Class test	15 Marks
Course prerequisites:	To study this course, a student must have passed Master's Degree in Chemistry

Programme: Post graduate diploma in Research (PGDR)	Year: six (6)	Semester: XI
Subject: CHEMISTRY		
Course Code: B021103T	Course Title: Research Methodology, Research Publication Ethics and Computer Applications	
<p>Course Outcomes (COs)</p> <p>CO1: With the help of this course, students will be able to decide the research field, topic, design, and pros and cons of research, sampling, and data collection techniques.</p> <p>CO2: The student will be able to understand the research process and acquire the skill of writing research articles.</p> <p>CO3: The course will enable you to execute the best practices, morals, and ethical values in scientific conduct and avoid publication misconduct.</p> <p>CO4: With the help of this course, students will be able to learn about the standards of journals for good-quality publications of their research work.</p> <p>CO5: After this course, the students will be able to learn how to use computers and different application software for manuscript writing.</p> <p>CO6: This course will enable the students to learn about reference management and the maintenance of academic integrity using scientific tools. They will be familiar with the protection of the machines from computer hazards.</p>		
Credits: 4	Core Compulsory	
Max. Marks: 25 (CIE) + 75(UE)	Min. Passing marks: 55	
Total number of lectures: Lectures-Tutorial-Practical (4 hours in a week) L-T-P: 4-0-0 (60 hr)		

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Unit	Topics	No. of Lecture Hrs.
I	Research Methodology Definition, and Objectives, Motivation and Significance of Research, Types of Research, Truth and Facts of Research, Similarity and Contrast in Literary Research and Scientific Research, Research and Criticism, Research Problem and Research Design, Sampling Design and Methods of Data Collection.	12
II	Research standards: Layout of the Research Report, Research Process: subject Selection, Outline of the Research, Review of Literature, Material Collection; Testing and Classification, Analysis, Discussion and Conclusions, Precautions in Writing Synopsis/Research Paper/Thesis/Research Report.	12
III	Philosophy, Ethics, Scientific Conducts and misconduct Moral Philosophy, Nature of Moral Judgments and Reactions, Publication Ethics, Best Practices/Standards Setting Initiatives and Guidelines: Committee on Publication Ethics (COPE), World Association of Medical Editors (WAME) etc., Intellectual Honesty and Research Integrity: Falsification, Fabrication and Plagiarism (FFP), Open Access Publishing, and Publication Misconduct.	08
IV	Databases and Research Metrics Databases: Indexing Databases, Citation Databases: Web of Science, Scopus etc., Research Metrics: Impact Factor of Journal as Per Journal Citation Report, SNIP, SJR, IPP, Cite Score; Metrics: h-Index, g-Index, i-10 Index, and Altmetric.	08
V	Fundamentals of Computers and application Softwares Types Of Computers, Computer Peripherals and internal component, Types of Operating Systems, Web Browser, Web Search Engine, Spreadsheet Processing, Presentation (MS PowerPoints Preparation or Beamer or Libre Office (Optional), Project/Thesis/Report writing, Using MS-Word or LaTeX or LibreOffice documentation style labelling, References Style, Footnotes etc.	12
VI	Scientific Softwares Use of Reference Management Software Like Mendeley, Zotero, Reference Manager, Endnote, Authorea Etc. Anti-Plagiarism Software Like Turnitin, iAuthenticate, Urkund, Ebooks and Virtual Library, UGC-Infonet, Computer Hazards and Security	08

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Suggested Readings:

1. C.R. Kothari, *Research methodology Methods and Techniques*, 4th Edition, New Age International (P) Ltd. Publisher, 2014.
2. W. Creswell, *Research Design, Qualitative, Quantitative and mixed method approaches*, 3rd Edition, Sage Publications, Inc.
3. D.B. Resnik, (2011) What is ethics in research & Why is it important. National institute of Environmental Health Science, 1-10 Retrieved from <https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm>
4. Indian National Science Academy (INSA), *Ethics in Science Education, Research and Governance* (2019), ISBN:978-81-939482-1-7. https://www.insaindia.res.in/pdf/Ethics_Book.pdf
5. Reema Thareja (2019) *Fundamentals Of Computers* (2nd Edition), Oxford University Press
6. *Microsoft Office 365 : A complete Guide to Master Word, Excel, and PowerPoint 365 for Beginners*, Matt Vic
7. Leslie Lamport, *LaTeX, A Document Preparation System*, 2nd Edition, Addison-Wesley Professional Publisher, July, 1994.
8. Latex tutorials <https://www.tug.org/twg/mactex/tutorials/ltxprimer-1.0.pdf>
9. Libre Office tutorial: www.documentation.libreoffice.org/en/english-documentation

Suggested equivalent online courses: <https://epgp.inflibnet.ac.in/>

Programme: Post graduate diploma in Research (PGDR)	Year: six (6)	Semester: XI
Subject: CHEMISTRY		
Course Code: B021104R	Course Title: Research Project	
Course Outcomes(COs) - CO1: Students will able to know about review of literature, references, experimental procedures etc.		
Credits: Non -Credit	Core Compulsory	
Max. Marks: 25 (CIE) + 75(UE)	Min. Passing marks: 55	




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