Date: 01.06.2022

To,

The Registrar
V.B.S. Purvanchal Universiy
Jaunpur (U.P.)

Sub. Syllabuses of the Master's Degree and Ph.D. Coursework in Chemistry developed as per the provisions under National Education Policy-2020 and duly passed by the Board of studies in Chemistry.

Dear Sir,

In compliance with your office letter No. 1477/Academic/2022 dated 30.04.2022 and Honourable Vice-Chancellor's instructions at a meeting held on 05 May 2022, the Board of Studies in Chemistry has re-structured the syllabuses of Master's Degree and Ph.D. Coursework programmes in Chemistry as per the Syllabus Development Guidelines under the National Education Policy-2020. Both the Syllabuses have been duly passed by the Board of Studies in Chemistry.

I, hereby, submit the final draft of the said syllabuses for necessary action.

With regards.

Yours faithfully

(Prof. Dharmendra Kumar Singh)
Convenor
Board of Studies in Chemistry
Head, Department of Chemistry
Tilak Dhari Postgraduage College,
Jaunpur

VEER BAHADUR SINGH PURVANCHAL UNIVERSITY, JAUNPUR

Syllabus for

Ph.D. Coursework in Chemistry

Designed As Per Syllabus Development Guidelines

Under

National Educational Policy – 2020

VEER BAHADUR SINGH PURVANCHAL UNIVERSITY, JAUNPUR

Syllabus for

Ph.D. Coursework in Chemistry

Designed as per Syllabus Development Guidelines under
National Education Policy – 2020

Consolidated list of papers

Titles of papers

Year	Semester	Course Code	Paper Title	Theory/ Practical	Credits
I	XI	B021101T	Paper 1: Techniques used in Chemistry	Theory	6
I	XI	B021102T	Paper 2: Chemistry	Theory	6
I	XI	B021103T	Paper 3: Research Methodology	Theory	4

Syllabus Developed by:

S.No.	Name	Designation	Department	College/University
1.	Prof. Dharmendra Kumar Singh	Professor	Chemistry	T.D. College Jaunpur
2.	Prof. Bharat Singh	Ex- Professor & Head	Chemistry	Allahabad University, Prayagraj
3.	Prof. Bachcha Singh	Ex- Professor & Head	Chemistry	Banaras Hindu University, Varanasi
4.	Prof. Ajay Kumar Shukla	Professor	Chemistry	T.D. College, Jaunpur
5.	Dr. Santosh Kumar Singh	Associate Professor	Chemistry	T.D. College, Jaunpur
6.	Dr. Rajani Singh	Associate Professor	Chemistry	T.D. College, Jaunpur
7.	Dr. Chitrasen Gupta	Associate Professor	Chemistry	Kutir PG College Chakke, Jaunpur
8.	Dr. Arun Kumar	Associate Professor	Chemistry	Hindu P.G. College, Zamania, Ghazipur
9.	Dr.Ram Dulare	Associate Professor	Chemistry	P.G. College, Ghazipur

Note: This syllabus is based on the syllabus (with modifications to the extent of 30%) developed by the committee of experts.

Programme Outcomes (POs) :

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

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

Programme Specific Outcomes (PSOs):

The scholars will be able to:

- Read, analyse and comprehend the basic and advanced rules of research methodology.
- Apply the knowledge of research documentation for communicating and presenting the findings.
- 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.
- Have understanding of different purification criteria of separation and be able to account for fundamental separation processes and their connection to molecular properties.
- IUPAC awareness on the world authority on chemical nomenclature terminology standardized methods of measurement.
- Characterize the structure of the compound using techniques like UV-VIS, IR, NMR & MS.
- Provide sufficient knowledge and their interest in inorganic, organic and physical chemistry.

There will be three papers of 100 marks each. 75 marks have been allotted to semester end examination and 25 marks to the continuous internal assessment.

Programme/Class: Ph.D. Coursework	Year: First	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:

- Understanding of different criteria of separation and be able to account for fundamental separation processes and their connection to molecular properties.
- Understanding the knowledge of purification of compounds by distillation, crystallization and chromatographic technique.
- Gain knowledge of analytical application by using UV-VIS, IR, NMR and MS technique.
- Learn the basic theory of x-ray diffraction methods, microscopic methods mechanical properties and electrical properties.

Credits: **06**	Paper: **Core Compulsory**
Max. Marks: **25+75**	Min. Pass Marks: .....

Total No. of Lectures-Tutorials-Practical (in hours per week): **6-0-0**.

Unit	Topic	No. of Lectures
I	**Section-A: Basic techniques used in Chemistry and their applications.** Basic theory (Melting point and Boiling point determination, Fractional distillation, Purification of compounds by crystallization, chromatography. Purification of solvents, evaporation of solvent-Steam distillation, solvent extraction, sublimation. Determination of percentage of C, H, N & S, Instrumentation and analytical applications of the following physical methods: spectroscopic [NMR, ESR, MS(EI, FAB), IR UV-VIS, and Atomic absorption], GC-MS, LPLC, Membrane processes and Gel Filtration.	**30**
II	**Section B: Techniques of Structural and Material Characterization.** Basic theory, instrumentation and analytical applications of the following physical methods: X-ray diffraction methods (powder method), Microscopic methods (Polarized optical microscope, SEM, TEM, AFM), Mechanical Properties (DMA), Rheological properties (Viscometer, Rheometer), Electrical properties (Conductivity).	**30**

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, Preatice Hall, New Delhi.
- J.M. Hollas, Modern Spectroscopy, John Wileyand sons, Chilester.
- 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 Last West Press, New Delhi.
- D.A. Skoog, F.J. Holler and T.A. Nieman, Principles of Instrumental Analysis, Harcourt Brace & Company, Florida.

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/Class:	Year:	Semester:
Ph.D. Coursework	**First**	**XI**

Subject: **CHEMISTRY**

Course Code: -B021102T	Course Title: **Paper 2: Chemistry**

Course Outcomes:

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

- Focus on the synthesis and characterisation of coordination compounds with their application
- Provide background and sufficient knowledge and their interest in bioinorganic chemistry coordination chemistry, organic chemistry and physical chemistry.
- Focus on reactivity and synthesis in organic chemistry, application on the concept of gree chemistry in organic synthesis.
- Learn about reaction of chemical kinetics and thermodynamic investigation.

Credits: **06**	Paper: **Core Compulsory**
Max. Marks: **25+75**	Min. Pass Marks: .....

Total No. of Lectures-Tutorials-Practical (in hours per week): **6-0-0**.

Unit	Topic	No. of Lectures
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 biomineralizaion. 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:

- 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.

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/Class:	Year:	Semester:
Ph.D. Coursework	**First**	**XI**

Subject: **CHEMISTRY**

Course Code: -B021103T	Course Title: **Paper 3: Research Methodology**

Course Outcomes:

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

- Develop an understanding of research methodology and its basic concepts.
- Identify the trends in contemporary research to successfully formulate relevant resear questions.
- Comprehend the different mechanics of writing and effectively use them in their research.
- Understand and apply the virtual technologies in diverse areas of research.
- Know the role of computer in research.

Credits: **04**	Paper: **Core Compulsory**
Max. Marks: **25+75**	Min. Pass Marks: .....

Total No. of Lectures-Tutorials-Practical (in hours per week): **4-0-0**.

Unit	Topic	No. of Lectures
I	**Research Methods:** • Objective of Research, research problem and techniques in defining a problem. Steps of scientific study, Formulation of hypothesis, defining sources, workable hypothesis, Basis concept of research design. • Survey, case study (if required), Experimental methods, interdisciplinary approaches.	**10**
II	**Review of Literature:** • Need and significance of reviewing literature • Literature search procedure • Sources of literature • Planning of review work	**10**
III	**Research Ethics :** • Plagiarism • How to Avoid Plagiarism • Various Ways of Maintaining Ethics in Research	**15**
IV	**Techniques used in Research:** • Collection, Classification and tabulation of data, Measures of central tendency, Chi-square test. • Analysis and interpretation of data, techniques of interpretation, steps of report/review, research paper writing layout and presentation of report.	**15**
V	**Application of Computer in Research** • Introduction to computer, types of computers and components of computer. Role of computer in research,	**10**

Suggested Readings:

- John. Adam, "Research Methodology: Methods and Techniques", New Delhi, New Age International.
- B. Allison, "The Students Guide to Preparing Dissertations and Theses", London, Kogan Page, 1997.
- Iris. Blanc, *Computer Applications of the New Millennium*; Course Technology.
- R.K. Jain, *Course on Computer Concepts*; Macgraw Hill.
- C. R. Kothari, "Research Methodology- Methods and Techniques", New Delhi, New Age International

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**

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