DEPARTMENT OF CHEMISTRY
UNIVERSITY OF LUCKNOW
Four Year Undergraduate Course Structure:
Subject: Chemistry Semester I NEP (Revised)
For students admitted in session 2024-25 onwards

Semester I						
Paper	**Paper Title**	**Type**	**Credits**	**Internal Assessment**	**University Exam**	**Total Marks**
Paper 1	Inorganic Chemistry 1	Theory (Major)	4	25	75	100
Paper 2	Chemistry Practical 1	Practical (Major)	4	-	100	100
CC 1	Co-Curriculum 1	Laboratory Skills in Chemistry	2	25	75	100
P1”	Inorganic Chemistry 1A	Theory (Minor)	2	25	75	100
P1’	Second major subject	Theory	4	25	75	100
P2’	Second major subject	Theory	4	25	75	100
	Total Credits		**20**			

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Inorganic Chemistry 1 (Major)

Semester I **Paper 1** **Credits 4**

MM 100 (75 + 25)

Course outcome

Students admitted in B.Sc. Chemistry semester program will gain precise insight into the:

- **CO-1** Structure of atoms and associated important rules, importance of chemistry of elements.
- **CO-2** Ionic, covalent and non-covalent bonding which always play pivotal role in deciding the chemistry and properties of any compound/material.
- **CO-3** Periodic properties of elements and several parameters associated with elements
- **CO-4** Solid state chemistry which forms the basis of the development of targeted crystalline solids inculcating varied defects which induces variety of materials properties viz. piezoelectricity.
- **CO-5** Chemistry of elements belonging to s-block, noble gases and main group.

Unit 1

- **Atomic Structure:**
  - Quantum mechanics-based structure of atom in brief, shapes of s, p and d orbitals, Aufbau and Pauli exclusion principles, Hund's Multiplicity rules. Electronic configurations of the elements, effective nuclear charge.
- **Periodic Properties and Classification based upon electronic configuration:**
  - Diagonal relationship, inert pair effect, atomic and ionic radii, van der waal radii, ionization energy,
- **Electron affinity and electronegativity:**
  - Definition, method of determination, trends in periodic table and applications in predicting and explaining chemical behaviour.

Unit 2

- **Chemical Bonding**
  - Covalent bond: valence bond theory and its limitations, directional characteristic of covalent bond. Hybridization and shapes of simple molecules and ions. Valence Shell Electron Pair Repulsion (VSEPR) theory to simple molecules and ions. Molecular Orbital theory for homonuclear and heteronuclear (CO and NO) diatomic molecules, multi-center bonding in electron deficient molecules, bond strength and the bond energy, % ionic character from dipole moment and electronegativity difference.

- Weak interactions: hydrogen bonding, van der Waals forces.

Unit 3

- **Ionic solid:**
  - ionic structures, radius ratio effect and coordination number, limitation of ratio rule, Lattice defects, Lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarizability of ions. Fajan's rule, Metallic bond free electron, Valence bond and Band theories.
- **s-Block elements:**
  - Comparative study, salient features of hydrides, salvation and complexation tendencies of cations of alkali and alkaline earth matter including their function in biosystems, an introduction to alkyls and aryls of Li & Mg.
- **Noble Gases:**
  - Chemical properties of the noble gases, discovery of $O_2^+PtF_6^-$ and O_2XeF_6.Chemistry of xenon, structure and bonding in xenon compounds.

Unit 4

- **p-Block Elements:**
  - Comparative study (including diagonal relationship) physical and chemical behaviour of group 13-17 elements, compounds like hydrides, oxides, oxyacids and halides ofgroup 13-16, diborane, boronitride α, β forms, Fullerenes, silicates(structural principle) andstructures of oxides and oxyacids of phosphorus and sulphur, interhalogens and polyhalides.

Text Books (Theory Courses):

1. Concise Inorganic Chemistry, J.D. Lee, Blackwell Science Ltd.
2. Inorganic Chemistry, Puri, Sharma, Kalia and Kaushal.
3. Pradeep's Inorganic Chemistry, K.K. Bhasin, Pradeep Publication.
4. Chemistry for degree students, R. L. Madan

Reference Books:

1. Inorganic Chemistry, J.E. Huheey, Ellen A. Keiter, Richard L. Keiter, Addison Wesley Longman (Singapore) Pvt. Ltd.
2. Inorganic Chemistry, D.E. Shriver, P W. Atkins and C.H.L. Langford, Oxford.
3. Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson and P.L. Gaus, Wiley.
4. Concepts of Models of Inorganic Chemistry, B. Douglas, D. McDaniel and J Alexander, John Wiley.
5. Inorganic Chemistry, W.W. Porterfield, Addison - Wesley.
6. Inorganic Chemistry, A.G. Sharpe, ELBS
7. Inorganic Chemistry, G.L. Meissler and D.A. Tarr, Prentice- Hall.

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Inorganic Chemistry 1A (Minor)

Semester I **P1"** **Credits 2**

MM 100 (75 + 25)

Course Outcome

- Students will gain further understanding into the atomic structure, periodic properties of elements and several important property trends of elements.
- Students will gain understating into the covalent, ionic and non-covalent interactions.

Unit 1

- **Atomic Structure:**
  - Quantum mechanics-based structure of atom in brief, shapes of s, p and d orbitals, Aufbau and Pauli exclusion principles, Hund's Multiplicity rules. Electronic configurations of the elements, effective nuclear charge.

Unit 2

- **Periodic Properties and Classification based upon electronic configuration:**
  - Diagonal relationship, inert pair effect, atomic and ionic radii, van der waal radii, ionization energy,
- **Electron affinity and electronegativity:**
  - Definition, method of determination, trends in periodic table and applications in predicting and explaining chemical behaviour.

Unit 3

- **Chemical Bonding I**
  - Covalent bond: valence bond theory and its limitations, directional characteristic of covalent bond. Hybridization and shapes of simple molecules and ions. Valence Shell Electron Pair Repulsion (VSEPR) theory to simple molecules and ions.

Unit 4

- **Chemical Bonding II**
  - Molecular Orbital theory for homonuclear and heteronuclear (CO and NO) diatomic molecules, multi-center bonding in electron deficient molecules, bond strength and the bond energy, % ionic character from dipole moment and electronegativity difference.
  - Weak interactions: hydrogen bonding, van der Waals forces.

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(d) Concepts of Models of Inorganic Chemistry, B.Douglas, D.McDaniel and J Alexander, John Wiley.
(e) Inorganic Chemistry, W.W. Porterfield, Addison - Wesley.
(f) Inorganic Chemistry, A.G. Sharpe, ELBS
(g) Inorganic Chemistry, G.L. Meissler and D.A. Tarr, Prentice-Hall.

Chemistry Practical 1 (Major)

Semester I **Paper 2** **Credits 4**

MM 100

Course Objective:

Students admitted in B.Sc. Chemistry semester program will gain precise insight into the experiments based on analysis of mixtures.

Course Outcomes:

- **CO-1.** the student will be able to analyse the given mixture and identify anions and cations present.
- **CO-2.** achieve knowledge about different types of reaction.
- **CO-3.** understand various tests to identify the radicals.
- **CO-4.** able to write reactions and structure.
- **CO-5.** acquire the skill to perform the experiment in the real lab once they understand different steps in the procedure.
- **CO-6.** Having expertise in making solutions accurately.
- **CO-7.** To acquired enough knowledge to answer questions based on experiments.

Inorganic Chemistry

- **Qualitative Analyses:**
  - Identification of cations and anions in a mixture of inorganic compounds soluble in water/dilute acids (Macro/semi-micro analysis- cation analysis, separation of ions from group 0-VI, anion analysis). Only six radicals.

Record & Viva

Books Recommended

1. Chemistry Practical by S. Giri, D.N. Bajpai and O.P. Pandey, S. Chand Publication.
2. Practical Chemistry Volume 1-3 by Fateh Bahadur, Vishal Publication
3. Systematic Chemistry Practical, P.C. Kamboj, Vishal Publication

Distribution of Maximum Marks:

The maximum marks in the evaluation of the practical exercises, viva-voce and records of their class-work are given below.

Chemistry Practical 1				
Class	Inorganic Chemistry	Viva	Class Record	Total
B.Sc. Semester I	60	30	10	100

Note: For exempted students, marks of class record will be added to the marks of viva-voce for practical examinations since they do not have the class record.

Laboratory Skills in Chemistry

Semester I **Co Curriculum 1** **Credits 2**
MM 100 (75 + 25)

- **Course Outcomes**
  - CO 1: Students will apply fundamental chemical principles to solve problems, interpret data and explain outcomes.
  - CO 2: Students will learn a variety of laboratory techniques to safely conduct chemical experiments and procedures

UNIT-I

- **General Introduction**
  - Introduction of the chemistry laboratory, and common instructions for safe working in chemical laboratories.
- **Laboratory Arrangement**
  - Lab design, Storage, ventilation, lighting, fume, cupboard, arrangement of the store, and Safety provisions.

UNIT-II

- **Apparatus**
  - Glass apparatus - Beaker, Test tube, boiling tube, funnel, separating funnel, filtration flask, round bottom flask, flat bottom flask, condenser Liebig flask, watch glass, etc. measuring conical or condenser, Petri dish, desiccator.
  - Volumetric Apparatus - Measuring cylinder, burette, pipette, Volumetric flask, analytical balance, single-pan electronic balance/ electrical analytical balance, etc.

UNIT-III

- **Handling**
  - Cleaning, handling and storage of glassware and apparatus, Management of preparation room**.**
  - Common Laboratory chemicals and solvents.

UNIT-IV

- **Solutions and Solvents**
  - Water as solvent, types of water, solutions, components of a solution, types of solution, and solubility.
  - Concentration of solutions: percentage, molarity, normality, molality (in ppm) calculation of masses and volumes for preparation of solutions solids, liquids.

Books Recommended

1. Laboratory safety for chemistry students (Robert H. Hill and David C. Finster), ISBN:978-0-470-34428-6
2. Chemistry Laboratory skills by Philip Allan ISBN:978-1-4441-0843-9