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

Semester IV						
Paper	**Paper Title**	**Type**	**Credits**	**Internal Assessment**	**Univ Exam**	**Total Marks**
Paper 7	Inorganic Chemistry 2	Theory (Major)	4	25	75	100
Paper 8	Chemistry Practical 4	Practical (Major)	4	-	100	100
VC 1	Chemistry Vocational 2 (VC 2)	Introduction of Household Chemicals, Soaps and Detergents	2	25	75	100
P4”	Inorganic Chemistry 2A	Theory (Minor)	2	25	75	100
P3’	Second major subject	Theory	4	25	75	100
P4’	Second major subject	Theory	4	25	75	100
	Total Credits		**20**			

Inorganic Chemistry 2 (Major)

Semester IV **Paper 7** **Credits 4**

MM 100 (75 + 25)

Course outcome

- **CO-1** Chemistry of transition and inner-transition elements. These insights are important as they help in the rational selection of the cations of these elements for tailor-made syntheses of newer complexes
- **CO-2** Concepts of coordination chemistry and their applications
- **CO-3** Importance of different acid-base concepts which forms the basis of rational ligand designing and coordination complex formation for specific bio-inorganic, materials and optoelectronic applications.
- **CO-4** Importance and different chemical aspects of non-aqueous solvents which now-a-days are gaining importance in varied targeted syntheses of drugs and materials for technological applications

Unit 1

- **Chemistry of Elements of First Transition Series:**
  - Characteristic properties of d-block elements. Binary compounds (hydrides, carbides and oxides) of the elements of the first transition series and complexes with respect to relative stability of their oxidation states, coordination number and geometry.
- **Chemistry of Elements of Second and Third Transition series:**
  - General characteristics, comparative treatment of Zr/Hf, Nb/Ta , Mo/W in respect of ionic radii, oxidation states, magnetic behavior, spectral properties and stereochemistry.

Unit – 2

- **Coordination Compounds:**
  - Werner's coordination theory and its experimental verification, Sidgwick's concept of effective atomic number, EAN concept, Polydentate ligands or chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes, Inner and outer orbital complexes, Limitations of VBT.

Unit 3

- **Chemistry of Lanthanide Elements:**
  - Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, ceric ammonium sulphate and its analytical uses.
- **Chemistry of Actinides:**
  - Electronic conformation, oxidation states and magnetic properties, chemistry of separation of Np, Pu and Am from U.

Unit 4

- **Oxidation and Reduction:**
  - Electrode potential, electrochemical series and its applications. Principles involved in the extraction of the elements.
- **Acids and Bases:**
  - Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concept of acids and bases.
- **Non-aqueous Solvents:**
  - Physical properties of a solvent, types of solvents and their general characteristics, Reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2.

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 Publication

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. Mc Daniel 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

Inorganic Chemistry 2 A (Minor)

Semester IV **P4"** **Credits 2**

MM 100 (75 + 25)

Course Outcome

- Students will gain information about the property trends and important reactions associated with the transition and inner transition elements.
- Students will learn about the basic concepts of coordination chemistry and related concepts of isomerism.

Unit 1

- **Chemistry of Elements of First Transition Series:**
  - Characteristic properties of d-block elements. Binary compounds (hydrides, carbides and oxides) of the elements of the first transition series and complexes with respect to relative stability of their oxidation states, coordination number and geometry.

Unit – 2

- **Chemistry of Elements of Second and Third Transition series:**
  - General characteristics, comparative treatment of Zr/Hf, Nb/Ta , Mo/W in respect of ionic radii, oxidation states, magnetic behavior, spectral properties and stereochemistry.

Unit – 3

- **Coordination Compounds I:**
  - Werner's coordination theory and its experimental verification, Sidgwick's concept of effective atomic number, EAN concept, Polydentate ligands or chelates, nomenclature of coordination compounds,

Unit – 4

- **Coordination Compounds II:**
  - isomerism in coordination compounds, valence bond theory of transition metal complexes, Inner and outer orbital complexes, Limitations of VBT.

Text Books (Theory Courses):

a. Concise Inorganic Chemistry, J.D. Lee, Blackwell Science Ltd.
b. Inorganic Chemistry, Puri, Sharma, Kalia and Kaushal.
c. Pradeep's Inorganic Chemistry, K.K. Bhasin, Pradeep Publication.
d. Chemistry for degree students, R. L. Madan

Reference Books:

a. Inorganic Chemistry, J.E.Huheey, Ellen A. Keiter, Richard L. Keiter, Addison Wesley Longman (Singapore) Pvt. Ltd.
b. Inorganic Chemistry, D.E.Shriver, P W. Atkins and C.H.L. Langford, Oxford.
c. Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson and P.L. Gaus, Wiley.

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

Chemistry Practical 4 (Major)

Semester IV **Paper 8** **Credits 4**

MM 100

Course Objective:

- After successful completion of the third semester of under-graduation, students coming in this semester for practical's will be provided knowledge about the experiments based on volumetric and gravimetric.

Course Outcomes:

- **CO-1.** achieve knowledge about different types of redox reactions.
- **CO-2.** able to write reactions and structure.
- **CO-5.** acquire the skill to perform the experiment in the real lab once theyunderstand 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 Quantitative Analysis:

- **Volumetric Analysis**
  - Determination of acetic acid in commercial vinegar using NaOH
  - Estimation of calcium content in chalk as calcium oxalate by permanganometry
  - Estimation of ferrous ions by dichromate method
  - Estimation of copper using iodometric method.
- **Gravimetric Analysis**
  - Ba as $BaSO_4$ in the given solution of $BaCl_2$
  - Analysis of Ni as $Ni(DMG)_2$

Record & Viva

Books Recommended

(a) Chemistry Practical by S. Giri, D.N. Bajpai and O.P. Pandey, S. ChandPublication.
(b) Practical Chemistry Volume 1-3 by Fateh Bahadur, Vishal Publication
(c) 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 4				
Class	Inorganic Chemistry	Viva	Class Record	Total
B.Sc. Semester IV	60 (35 + 25)	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.

Introduction of Household Chemicals, Soaps and Detergents

Semester IV **Chemistry Vocational VC 2** **Credits 2**

MM 100 (75 + 25)

Course Outcome

- CO 1 To expose the students to various emerging new areas of Chemistry and apprise them with their prevalent in their future studies and their applications in various spheres of chemical sciences.
- CO 2 To enhance student sense of enthusiasm for chemistry and to involve them in an intellectually stimulating experience of learning in a supportive environment.
- CO3 To enhance practical knowledge
- CO4 To motivate self-employment ability
- CO5 To create self-efficiency

Unit 1

- **Household chemicals**:
  - History of household Industry, Basic Theory of Household Chemicals, and Raw material required for household product, Product manufacture in household industry. Role of household product in day-to-day life.

Unit 2

- **Cleaning agents**:
  - Introduction, synthesis and applications of Natural cleaning agents, cleaning action, Floor cleaner, Toilet Cleaner, Bathroom Cleaner, Kitchen Cleaner

Unit 3

- **Technology of Soap**:
  - Chemistry of soap; Raw material for soap industry and their selection; hard fats yielding and oil yielding soaps; Chemical reactions of soaps; Hard and Soft soaps; Plant and process employed in soap manufacture; Liquid hand wash and liquid dish wash.

Unit 4

- **Detergents and surfactants**:
  - Introduction; Different terms used in detergents; Raw materials for detergents; Washing action of detergents; Types of detergents; Introduction of surfactants; Types of surfactants.

Recommended Books:

1. Small scale industries and house hold industries in developing economy by Shetty M.C.
2. Manufacture of perfume cosmetics and detergents by Giri Raj Prasad .
3. Industrial chemistry by B.K. Sharma
4. Flavours & Essential oils, Industries SBP Board
5. Perfumes soaps & cosmetics by Poucher.