Semester	**1**
Programme	**CHEMISTRY**
Course	**MAJOR (INORGANIC CHEMISTRY 1)**
Paper Code	**C1CH230121T**
Credits	**4 (THEORY: 4)**
Hours/week	**4 (THEORY: 4)**
Category: Core/MDC/SEC/VEC	**CORE**
Theory / Practical / Composite	**THEORY**
Number of Modules	**4 (THEORY: 4)**
Syllabus	**Theory:** **Module 1: Extra nuclear Structure of atom (12 Lectures)** Atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of $\psi$and ψ^2. Quantum numbers and their significance. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of s, p, d and f orbitals. Pauli's Exclusion Principle, Hund's rules, Exchange energy, Aufbau principle and its limitations, Ground state Term symbols of atoms and ions for atomic number upto 30. **Module 2: Periodic Properties (12 Lectures)** Modern IUPAC Periodic table, Effective nuclear charge, screening effects and penetration, Slater's rules, atomic radii, ionic radii (Pauling's univalent), covalent radii, scandide contraction, lanthanide contraction. Ionization potential, electron affinity and electronegativity (Pauling's, Mulliken's and Allred-Rochow's scales) and factors influencing these properties, group electronegativities. Group trends and periodic trends in these properties in respect of s-, p- and d-block elements. Secondary periodicity, Relativistic Effect, Inert pair effect. **Module 3: Covalent Bonding-I (12 Lectures)** VSEPR Theory to predict the structure and stereochemistry of simple molecules; Idea of stereo chemically active and inactive lone pair, concept of hybridization, Bent's Rule and applications; Pseudo-rotation, Resonance and its applications, Dipole moment, VBT (Hitler & London) **Module 4: Coordination Chemistry: Basics and Isomerism (12 Lectures)** Werner's theory and allied conceptions in coordination complexes, Classification and types of ligands, chelates, chelate effect and macrocyclic effect; Coordination numbers, IUPAC nomenclature of coordination complexes (up to two metal centers), Isomerism in

	coordination compounds, constitutional and stereo isomerism, Geometrical and optical isomerism in square planar, tetrahedral and octahedral complexes.
Course Overview	**Theory:** 1. This course provides a comprehensive introduction to the fundamental principles of inorganic chemistry. 2. It begins with the wave mechanical model of the atom, exploring the Schrödinger equation, quantum numbers, and the radial/angular distribution of orbitals. 3. To have basic knowledge about the wave mechanical model of an atom, the concept of Atomic Orbital and ground state terms. 4. To develop the idea of periodic table and periodic properties 5. The curriculum delves into periodic properties and trends across the s-, p-, and d-blocks, including advanced concepts like lanthanide contraction and the relativistic effect. 6. To be acquainted with the several theories of bonding in accordance with the Valence Bond Theory 7. Students will study covalent bonding through VSEPR theory, Bent's rule, and Valence Bond Theory (VBT) to predict molecular geometry. 8. Finally, the course introduces coordination chemistry, focusing on Werner's theory, IUPAC nomenclature, and the complexities of constitutional and stereoisomerism in coordination complexes. 9. To realize the nature of ligands and the coordination complexes, their IUPAC names and isomeric forms
Course Outcomes (COs)	Upon successful completion of this course, students will be able to: **CO1**:Recall and explain the fundamental postulates of wave mechanics, including the de Broglie equation, Heisenberg's uncertainty principle, and the Schrödinger wave equation, and differentiate between the significance of ψ and ψ^2. **CO2**: Interpret the four quantum numbers, construct radial and angular distribution curves, and illustrate the shapes of s, p, d, and f orbitals using the hydrogen atom as a reference. **CO3**: Apply Pauli's Exclusion Principle, Hund's Rules, and the Aufbau principle (and recognize its limitations) to derive the ground-state electronic configurations and determine the ground-state term symbols for atoms and ions ($Z \leq 30$). **CO4**: Calculate the effective nuclear charge (Zeff) using Slater's rules and correlate it with periodic trends such as atomic radii, ionic radii, ionization energy, and electron affinity. **CO5**: Compare and contrast the various scales of electronegativity (Pauling, Mulliken, and Allred-Rochow) and explain advanced periodic phenomena including the lanthanide contraction, scandide contraction, inert pair effect, and relativistic effects. **CO6**: Predict the three-dimensional structures and stereochemistry of simple covalent molecules using VSEPR theory, differentiating between stereo chemically active and inactive lone pairs. **CO7**: Analyze the hybridization of central atoms using Bent's rule and apply the concepts of resonance and dipole moment to justify the structure and polarity of molecules. **CO8**: Explain the postulates of Werner's theory, classify various types of ligands, and justify the thermodynamic stability of chelates using the chelate and macrocyclic effects.

	CO9: Apply IUPAC rules to name coordination complexes (including bridged binuclear complexes) and deduce the formulae of complexes from their given names. **CO10**: Distinguish between constitutional and stereoisomerism, and differentiate geometrical and optical isomers in square planar, tetrahedral, and octahedral complexes by constructing 3-D representations and identifying chiral centers.
Program Outcomes (POs)	PO1: Fundamental Knowledge: Demonstrate a comprehensive understanding of core concepts in chemistry, including organic, inorganic, physical, analytical, and biochemistry. PO2: Laboratory Skills: Acquire hands-on experience in laboratory techniques and instrumentation, applying safety protocols and proper methodologies to conduct experiments and analyse results. PO3: Problem Solving: Develop critical thinking and problem-solving skills by applying chemical principles to real-world scenarios, including the ability to design experiments and interpret data. PO4: Research Competency: Engage in independent and collaborative research projects, employing scientific methods to formulate hypotheses, conduct experiments, and communicate findings effectively. PO5: Interdisciplinary Applications: Understand the interdisciplinary nature of chemistry, exploring its applications in fields such as medicine, environmental science, materials science, and nanotechnology. PO6: Communication Skills: Effectively communicate scientific information, both verbally and in written form, to diverse audiences, demonstrating the ability to present complex ideas clearly and concisely. PO7: Ethics and Sustainability: Recognize the ethical implications and responsibilities of scientific research and practice in chemistry, emphasizing the importance of sustainability and environmental stewardship in chemical practices.

CO #	**Course Outcome Summary**	**Bloom's Taxonomy (K-Level)**	**Mapped POs**
CO1	**Atomic Structure & Wave Mechanics**	**K1 (Remember), K2 (Understand)**	**PO1**
CO2	**Quantum mechanical Model of the atom**	**K2 (Understand), K3 (Apply)**	**PO1**
CO3	**Electronic configuration**	**K3 (Apply), K4 (Analyze)**	**PO1, PO3**
CO4	**Periodic Properties & Trends**	**K3 (Apply), K4 (Analyze)**	**PO1, PO3**
CO5	**Advanced Periodic Properties & Trends**	**K2 (Understand), K4 (Analyze)**	**PO1**

CO6	**VSEPR and Molecular shapes**	**K3 (Apply), K4 (Analyze)**	**PO1**
CO7	**VBT and associated properties**	**K4 (Analyze), K5 (Evaluate)**	**PO1, PO3**
CO8	**Coordination complexes and stability**	**K2 (Understand), K5 (Evaluate)**	**PO1**
CO9	**Nomenclature of Coordination complexes**	**K3 (Apply), K4 (Analyze)**	**PO1, PO3**
CO10	**Isomerism in Coordination complexes**	**K4 (Analyze), K5 (Evaluate)**	**PO1, PO3**

Reading/Reference Lists	Theory: 1. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford, 1970. 2. Atkin, P. Shriver & Atkins' Inorganic Chemistry, 5th Ed., Oxford University Press. 3. Cotton, F.A., Wilkinson, G. and Gaus, P.L., Basic Inorganic Chemistry 3rd Ed.; Wiley India. 4. Sharpe, A.G., Inorganic Chemistry, 4th Indian Reprint (Pearson Education). 4. Huheey, J. E.; Keiter, E.A. &Keiter, R.L. Inorganic Chemistry, Principles of Structure and Reactivity 4th Ed., Harper Collins 1993, Pearson. 5. Mingos, D.M.P., Essential trends in inorganic chemistry. Oxford University Press. 6. Winter, M. J., The Orbitron, http://winter.group.shef.ac.uk/orbitron/. An illustrated gallery of atomic and molecular orbitals. 7. Burgess, J., Ions in solution: basic principles of chemical interactions. Ellis Horwood. 8. Pfennig, B. W., Principles of Inorganic Chemistry. John Wiley & Sons. 9. Housecraft, C. E.; Sharpe, A. G., Inorganic Chemistry, 5th Edition, Pearson. 10. Wulfsberg, G., Inorganic Chemistry, Viva Books Private Limited.
Evaluation	Theory: 100 Internal: 30 (CIA: 20; Other form of Assessment: 5; Attendance: 5) Semester Exam: 70
Paper Structure for Theory Semester Exam	Answer SEVEN out of NINE Questions of 10 marks each.