

Govt. T. R. S. (Autonomous) College Rewa (M.P.)

Department of Chemistry

Syllabus for B.Sc. Chemistry

(CBCS & NEP 2020)

Session 2022-23

Part A - Introduction			
Program: UG (certificate)	Class: B.Sc. Chemistry	Semester: I	Session: 2022-23
Subject: Chemistry			
1	Course code	CHCT-01	
2	Course title	INORGANIC CHEMISTRY-I	
3	Course type	Major/Minor	
4	Pre-requisite (if any)	To study this course, a student must have had the subject Chemistry in class 12th	
5	Course Objective	The course reviews the structure of the atom, which is a necessary pre-requisite in understanding the nature of chemical bonding in compounds. It provides basic knowledge about ionic, covalent and metallic bonding and explains that chemical bonding is best regarded as a continuum between the three cases. It discusses the periodicity in properties with reference to the <i>s</i> and <i>p</i> block, which is necessary in understanding their group chemistry.	
6	Course Learning Outcomes (CLO)	After completing this course, the students will be able to <ul style="list-style-type: none">• Solve the conceptual questions using the knowledge gained by studying the quantum mechanical model of the atom, quantum numbers, electronic configuration, radial and angular distribution curves, shapes of <i>s</i>, <i>p</i>, and <i>d</i> orbitals, and periodicity in atomic radii, ionic radii, ionization energy and electron affinity of elements.• Draw the plausible structures and geometries of molecules using Radius Ratio Rules, VSEPR theory and MO diagrams (homo- & hetero-nuclear diatomic molecules).• Understand the concept of lattice energy using Born-Landé and Kapustinskii expression.• Rationalize the conductivity of metals, semiconductors and insulators based on the Band theory.	

		<ul style="list-style-type: none"> Understand the importance and application of chemical bonds, inter-molecular and intra- molecular weak chemical forces and their effect on melting points, boiling points, solubility and energetics of dissolution. 	
7	Credit Value	4	
8	Total Marks	Max. Marks (40+60):	Min. Passing Marks:
Part B – Content of the course			
Total No. of Lectures-Tutorials-Practical (4 hours per week):			
L-T-P: 45-0-00			
Unit	Topic		No. of Lectures
1	<p>a) Chemical Techniques in ancient India: General Introduction</p> <p>b) Contribution of ancient Indian scientists in chemistry e.g. metallurgy, dyes, pigments, cosmetics, Ayurveda, Charak Sanhita.</p> <p>Atomic Structure:</p> <p>Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de' Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and ψ^2. Quantum numbers and their significance. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of s, p, d and f orbitals. Contour boundary and probability diagrams. Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number.</p>		15
2	<p>Periodicity of Elements:</p> <p>s, p, d, f block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to s and p-block.</p> <p>(a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table.</p> <p>(b) Atomic radii (van'der Waals)</p> <p>(c) Ionic and crystal radii.</p> <p>(d) Covalent radii (octahedral and tetrahedral)</p> <p>(e) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy.</p>		10

	(f) Electron gain enthalpy, trends of electron gain enthalpy. (g) Electronegativity, Pauling, Mullikan, Allred Rachow scales, electronegativity and bond order, partial charge, hybridization, group electronegativity. Sanderson electron density ratio.	
3	<p>Chemical Bonding:</p> <p>(i) Ionic bond: General characteristics, types of ions, size effects, radius ratio rule and its limitations. Packing of ions in crystals. Born-Landé equation with derivation, expression for lattice energy. Madelung constant, Born-Haber cycle and its application, Solvation energy.</p> <p>(ii) Covalent bond: Lewis structure, Valence Shell Electron Pair Repulsion Theory (VSEPR), Shapes of simple molecules and ions containing lone-and bond-pairs of electrons multiple bonding, sigma and pi-bond approach, Valence Bond theory, (Heitler-London approach). Hybridization containing s, p and s, p, d atomic orbitals, shapes of hybrid orbitals, Bents rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of simple homonuclear and heteronuclear diatomic molecules, MO diagrams of simple tri and tetra-atomic molecules, e.g., N₂, O₂, C₂, B₂, F₂, CO, NO, and their ions; HCl, BeF₂, CO₂, HCHO, (idea of s-p mixing and orbital interaction to be given). Covalent character in ionic compounds, polarizing power and polarizability. Fajan rules, polarization. Ionic character in covalent compounds: Bond moment and dipole moment. ionic character from dipole moment and electronegativities.</p>	10
4	<p>Metallic bonding and Weak chemical forces:</p> <p>(iii) Metallic Bond: Qualitative idea of free electron model, Semiconductors, Insulators.</p> <p>(iv) Weak Chemical Forces: van'der Waals, ion-dipole, dipole-dipole, induced dipole dipole induced dipole interactions, Lenard-Jones 6-12 formula, hydrogen bond, effects of hydrogen bonding on melting and boiling points, solubility, dissolution.</p>	10

Part C – Learning Resources

Text Books, Reference Books, Other resources

Suggested Reading:

1. Lee, J. D. Concise Inorganic Chemistry, Wiley, 5th Edn .
2. Douglas, B.E., McDaniel, D.H., Alexander J.J., Concepts & Models of Inorganic Chemistry, (Third Edition) John Wiley & Sons, 1999.
3. Atkins, P. W. and DePaula, J. Physical Chemistry, Tenth Edition, Oxford University Press, 2014.
4. Rodger, G. E. Inorganic and Solid State Chemistry, Cengage Learning, 2002.

Suggested equivalent online:	
Part D – Assessment & Evaluation	
Suggested Continuous Evaluation Method	
Any remark / suggestion:	
This course can be opted as an elective by the students of the following subjects: Open for All	
Continuous & Comprehensive Evaluation shall be based on allotted Assignment and Class Test	

Keywords:

Atomic Structure, Wave function, Quantum Numbers, Electronegativity, Ionic Bonding, Dipole Moment, VSEPR Theory, Covalent Bonding, Multiple Bonding, Molecular Orbitals, Bonding MO, Antibonding MO, Homonuclear, Heteronuclear, Metallic Bonding, Weak Chemical Forces.

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Session 2022-23

Part A - Introduction

Program: UG (Certificate)	Class: B.Sc. Chemistry	Semester: I	Session: 2022-23
Subject: Chemistry (Honours)			
1	Course code	CHCP-01	
2	Course title	INORGANIC CHEMISTRY (PRACTICAL)	
3	Course type	Major/Minor	
4	Pre-requisite (if any)	To study this course, a student must have had the subject Chemistry in class 12th	
5	Course Objective	<ul style="list-style-type: none">• To eliminating the fear associated with chemistry laboratory,• To develop inquisitive nature about processes and phenomena happening during experiments.• To attain knowledge about methods and techniques related to experiments in laboratory.	
6	Course Learning Outcomes (CLO)	After completing this course, the students will be able to <ul style="list-style-type: none">• Calibrate the apparatus and remove errors• Prepare solution for experiment• Standardize the solution	
7	Credit Value	2	

8	Total Marks	Max. Marks (40+60):	Min. Passing Marks:
Part B – Content of the course			
Total No. of Lectures-Tutorials-Practical (4 hours per week):			
L-T-P: 00-0-15			
Unit	Topic		No. of Lectures
1	<p>(A) Titrimetric Analysis</p> <p>(i) Calibration and use of apparatus.</p> <p>(ii) Preparation of solutions of different Molarity/Normality of titrants.</p> <p>(iii) Use of primary and secondary standard solutions.</p> <p>(B) Acid-Base Titrations</p> <p>(i) Estimation of carbonate and hydroxide present together in mixture.</p> <p>(ii) Estimation of carbonate and bicarbonate present together in a mixture.</p> <p>(iii) Estimation of free alkali present in different soaps/detergents</p> <p>(C) Oxidation-Reduction Titrimetry</p> <p>(i) Estimation of Fe(II) and oxalic acid using standardized KMnO₄ solution.</p> <p>(ii) Estimation of oxalic acid and sodium oxalate in a given mixture.</p> <p>(iii) Estimation of Fe(II) with K₂Cr₂O₇ using internal (diphenylamine, anthranilic acid) and external indicator.</p>		15
Part C – Learning Resources			
Text Books, Reference Books, Other resources			
Suggested Reading:			
<ol style="list-style-type: none"> 1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis Sixth Edition, Pearson, 2009. 2. Svehala G. and Sivasankar I. B, Vogel's Qualitative Inorganic Analysis, Pearson, India, 2012. 			
Suggested equivalent online:			

Part D – Assessment & Evaluation
Suggested Continuous Evaluation Method
Any remark / suggestion:
This course can be opted as an elective by the students of the following subjects: Open for All
Continuous & Comprehensive Evaluation shall be based on allotted Assignment and Class Test

Keywords:

Titrimetric analysis, acid-base titrations, oxidation-reduction titrations, estimation, titrants.