

**KOLHAN UNIVERSITY, CHAIBASA
JHARKHAND**



**Revised Curriculum and Credit Frame Work
For SEM – I
As per FYUGP, NEP- 2020
(U.G. Chemistry – 2022 Onward)**

**University Department of Chemistry
Kolhan University, Chaibasa
West Singhbhum, Jharkhand-833202**

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| Sem | Code | Papers | Credits (Th +P) |
|-----|-----------|--|-----------------|
| I | MJ-1 | Major Paper-1 (Inorganic Chemistry) | 3 + 1 |
| | MN-1 | Minor Paper-1 (Inorganic Chemistry) | 3 + 1 |
| | MDC/IRC-1 | Multi-Disciplinary/Introductory Regular Course | 3 + 0 |

- **For End Semester Examination (ESE 60 marks, 3Hrs Exam):**

There will be **two** group of question. **Group A is compulsory** which will **contain** three questions. **Question No. 1 will be very sort answer type** consisting of five questions of 1 mark each. **Question No. 2 & 3 will be short answer type** of 5 marks. **Group B will contain descriptive type** five question of fifteen marks each, out of which any three are to answer.

- **For End Semester Examination (ESE 75 marks, 3Hrs Exam):**

There will be **two** groups of questions. **Group A is compulsory** which will contain three questions. **Question No. 1 will be very short answer type** consisting of five questions of 1 mark each. **Question No. 2 & 3 will be short answer type** of 5 marks. **Group B will contain descriptive type** six questions of fifteen marks each, out of which any four are to answer.

Semester-I
PAPER Title: Major Paper-1 (MJ-1)
Credits - 03

Learning objective:

- Atomic theory and its evolution
- Elements in periodic table; physical and chemical characteristics, periodicity
- Characterize bonding between atoms, molecules, interaction and energetic, hybridization and shapes of atomic, molecular orbital's, bond parameters, bond-distances and energies.

Inorganic Chemistry-1

| Unit | FM-60 Marks | Time 3hrs | Hours |
|------|---|-----------|-------|
| 1 | <p>Atomic Structure: 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> | | 10h |
| 2 | <p>Periodicity of Elements: 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. (a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table. (b) Atomic radii (van'der Waals) (c) Ionic and crystal radii. (d) Covalent radii (octahedral and tetrahedral) (e) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy. (f) Electron gain enthalpy, trends of electron gain enthalpy. (g)Electro negativity, Pauling, Mullikan, Allred Rachow scales, electro negativity and bond order, partial charge, hybridization, group electro negativity. Sanderson electron density ratio.</p> | | 10h |
| 3 | <p>Chemical Bonding: (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. (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 electro negativities.</p> | | 20h |
| 4 | <p>Metallic bonding and Weak chemical forces: Metallic Bond: Qualitative idea of free electron model, Semiconductors, Insulators. Weak Chemical Forces: van 'der Waals, ion-dipole, dipole-dipole, induced dipole-dipole interactions, hydrogen bond, effects of hydrogen bonding on melting and boiling points, solubility, dissolution.</p> | | 05h |

Sessional Internal Assessment (SIA) Full Marks – 15 Marks

A – Internal written Examination – 10 Marks (1 Hr)

B – Over All Performance Including Regularity – 05 Marks

Books Recommended:

- Advanced Inorganic Chemistry by Cotton and Wilkinson
- Principles of Inorganic Chemistry by Puri, Sharma and Kalia
- Inorganic Chemistry, by Moillers
- Pradeep's Inorganic Chemistry, Vol.- I, II and III
- Dinesh Inorganic Chemistry, Vol.- I, II and III
- Text Book of Inorganic Chemistry by P.L. Soni
- Selected Topics in Inorganic by Satyaprakash, Malik, Madan and Tuli
- Advanced Inorganic Chemistry by Gurdeep and Harish

Semester-I

PAPER Title: Chemistry Practical - MJ-1 LAB

Credits - 01

FM-25 Marks

Pass Marks - 10

Content

Titrimetric Analysis

(A) Preparation of solutions of different Molarity/Normality.

(B) Acid-Base Titrations

(i) Estimation of carbonate and hydroxide present together in mixture.

(ii) Estimation of carbonate and bicarbonate present together in a mixture.

(C) Oxidation-Reduction Titration

(i) Estimation of Fe (II) and oxalic acid using standardized KMnO_4 solution.

(ii) Estimation of oxalic acid and sodium oxalate in a given mixture.

(iii) Estimation of Fe (II) with $\text{K}_2\text{Cr}_2\text{O}_7$ using internal (diphenylamine, anthranilic acid) and external indicator.

(D) Iodometry

(i) Estimation of Cu using standardized solution of Sodium Thiosulphate Solution.

Experiments – 15 Marks

Viva-Voice – 05 Marks

Notebook – 05 Marks

Semester-I
PAPER Title: Minor Paper-1 (MN-1)
Credits - 03

Learning objective:

- Atomic theory and its evolution
- Elements in periodic table; physical and chemical characteristics, periodicity
- Characterize bonding between atoms, molecules, interaction and energetic, hybridization and shapes of atomic, molecular orbital's, bond parameters, bond-distances and energies.

Inorganic Chemistry-1

| Unit | FM-60 Marks | Content | Time 3hrs | Hours |
|------|-------------|---|-----------|-------|
| 1 | | <p>Atomic Structure: Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance. Shapes of s, p, d and f orbital's. Contour boundary and probability diagrams. Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau principle and its limitations, Variation of orbital energy with atomic number.</p> | | 12h |
| 2 | | <p>Periodicity of Elements: 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. (a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table. (b) Atomic radii (van'der Waals) (c) Ionic and crystal radii. (d) Covalent radii (octahedral and tetrahedral) (e) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy. (f) Electron gain enthalpy, trends of electron gain enthalpy. (g)Electro negativity, Pauling, Mullikan, Allred Rachow scales, electro negativity and bond order, partial charge, hybridization, group electro negativity. Sanderson electron density ratio.</p> | | 12h |
| 3 | | <p>Chemical Bonding: (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. (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 electro negativities. (iii) Metallic bonding: Metallic Bond: Qualitative idea of free electron model, Semiconductors, Insulators.</p> | | 21h |

Sessional Internal Assessment (SIA) Full Marks – 15 Marks

A – Internal written Examination – 10 Marks (1 Hr)

B – Over All Performance Including Regularity – 05 Marks

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Semester-I

PAPER Title: Chemistry Practical - MN-1 LAB

Credits - 01

FM-25 Marks

Pass Marks - 10

Content

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(A) Preparation of solutions of different Molarity/Normality.

(B) Acid-Base Titrations

(i) Estimation of carbonate and hydroxide present together in mixture.

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(iii) Estimation of Fe (II) with $\text{K}_2\text{Cr}_2\text{O}_7$ using internal (diphenylamine, anthranilic acid) and external indicator.

Experiments – 15 Marks

Viva-Voice – 05 Marks

Notebook – 05 Marks