KOLHAN UNIVERSITY, CHAIBASA

JHARKHAND

Proposed Syllabus for FYUGP, NEP-2024
(UG – Chemistry 2025, Onward)

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

University Department of Chemistry
Kolhan University, Chaibasa
Jharkhand

Revised Curriculum and Credit Frame Work
As Per FYUGP, NEP - 2024
For U.G Chemistry w.e.f. 2025

Syllabus of U.G Chemistry has been prepared by the following members of Board of Studies (BOS)

1. **Dr. Gajendra K. Singh** **- Chairperson**
   HOD, Univ. Deptt. of Chemistry,
   K.U. Chaibasa

2. **Dr. Annapurna Jha** **- External Expert**
   Assistant Prof.
   Jsr. Women's University, Jamshedpur

3. **Dr. Anamika** **- External Expert**
   Assistant Prof.
   Jsr. Women's University, Jamshedpur

4. **Dr. Neeta Sinha** **- Member**
   Associate Prof.
   Jsr. Co-operative College, Jsr

5. **Dr. Brajesh Kumar** **- Member**
   HOD Chemistry,
   Tata College, Chaibasa

6. **Dr. Jagdish Prasad** **- Member**
   Assistant Prof.
   Tata College, Chaibasa

7. **Dr. Nazrul Islam** **- Member**
   Assistant Prof.
   JLN College, CKP

8. **Dr. Banashree Dey** **- Member**
   Assistant Prof.
   The Graduate School College Women's, Jsr

Kolhan University, Chaibasa
Jharkhand

Revised Curriculum and Credit Frame Work
As Per FYUGP, NEP - 2024
For U.G Chemistry w.e.f. 2025

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

Dr. Gajendra K. Singh (Chairman)
Dr. Annapurna Jha (External Expert)
Dr. Anamika (External Expert)
Dr. Neeta Sinha (Member)

Dr. Brajesh Kumar (Member)
Dr. Jagdish Prasad (Member)
Dr. Nazrul Islam (Member)
Dr. Banashree Dey (Member)

Semester - I

Paper Title: Major Paper - 1 (MJ-1)

Credits - 03

Learning objective:

- Some basic ideas of Chemistry like mole concept, strength of solution etc.
- 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

Unit	Content	Hours
1	**Some Basic Concepts of Chemistry :** Importance or studying chemistry, physical quantities and their SI units, dimensional analysis, precision and significant figures, classification of matter, laws of chemical combination, mole concept, strength of solution (Normality, Molarity, Molality etc.), , stoichiometry of chemical reactions.	05h
2	**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, Schrodinger'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 distribution curves. 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.	10h
3	**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.	10h
4	**Chemical Bonding:** **(i) Ionic bond:** General characteristics, types of ions, size effects, radius ratio rule and its limitations. Packing of ions in crystals. Born – Lande equation with dertivation, Expression for lattice energy. Mandelung constant, Born-Haber cycle and its application, Solvation energy. **(ii) Covalent bond:** Lewis structure, Valence Shell Electron Pair Repulsion((VSEPR) Theory, Shapes of simple molecules and ions containing lone-and bond-pairs of electrons multiple bonding, sigma and pi-bond approach, Valence Bond theory (VBT) Heitler London approach, Hybridization containing s, p & d atomic orbital's, shapes of hybrid orbital's, Bent Rule, resonance and resonance energy, Molecular orbital theory(MOT). Molecular orbital (MO) diagrams of simple homonuclear and heteronuclear diatomic molecules, MO diagrams of simple tri and tetra-atomic molecules, e.g., N_2, O_2, C_2, B_2, F_2, CO, NO, and their ions; HF, BeF_2, CO_2,. Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules, polarization. Ionic character in covalent compounds: Bond moment and dipole moment. Ionic character from dipole moment and electro negativities.	20h

Sessional Internal Assessment (SIA) Full Marks – 15 Marks
A - Internal written Examination - 10 Marks (1Hr.)
B – Over All Performance including Regularity – 05 Marks

Books Recommended:

- Principles of Inorganic Chemistry, Puri, Sharma and Kalia
- Concise Inorganic Chemistry, J.D. Lee
- Inorganic Chemistry, Moillers
- Text Book of Inorganic Chemistry, P.L. Soni
- Selected Topics in Inorganic, Satyaprakash, Malik, Madan and Tuli, S. Chand Publications
- Advanced Inorganic Chemistry, Gurdeep and Harish

Semester - I,

PAPER Title: Chemistry Practical - MJ-1 LAB

Credits - 01

Full Marks: 25 **Pass Marks: 10**

Content

Titrimetric Analysis :
(A) Preparation of solutions of different Molarity / Normality of titrants.

(**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 $K_2Cr_2O_7$ using internal (Diphenylamine, Anthranilic acid) and external indicator.

(D) Iodometry :
(i) Estimation of Cu using standardized Sodium Thiosulphate solution

Experiments - 15 Marks
Viva-Voce - 05 Marks
Notebook - 05 Marks

Semester - I

Paper Title: Associated Course - 1 (AC-1)

Credits - 03

Learning objective:

- Some basic idea of Chemistry like mole concept, strength of solution etc
- 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

Unit	Content	Hours
1	**Some Basic Concepts of Chemistry :** Importance or studying chemistry, physical quantities and their SI units, dimensional analysis, precision and significant figures, classification of matter, laws of chemical combination, mole concept, Strength of Solution (Normality, Molarity, Molality etc.), , stoichiometry of chemical reactions.	05h
2	**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, Schrodinger'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 distribution curves. 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.	10h
3	**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.	10h
4	**Chemical Bonding:** **(i) Ionic bond:** General characteristics, types of ions, size effects, radius ratio rule and its limitations. Packing of ions in crystals. Born – Lande equation with dertivation, Expression for lattice energy. Mandelung constant, Born-Haber cycle and its application, Solvation energy. **(ii) Covalent bond:** Lewis structure, Valence Shell Electron Pair Repulsion((VSEPR) Theory, Shapes of simple molecules and ions containing lone-and bond-pairs of electrons multiple bonding, sigma and pi-bond approach, Valence Bond theory (VBT) Heitler London approach, Hybridization containing s, p & d atomic orbital's, shapes of hybrid orbital's, Bent Rule, resonance and resonance energy, Molecular orbital theory(MOT). Molecular orbital (MO) diagrams of simple homonuclear and heteronuclear diatomic molecules, MO diagrams of simple tri and tetra-atomic molecules, e.g., N_2, O_2, C_2, B_2, F_2, CO, NO, and their ions; HF, BeF_2, CO_2,. Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules, polarization. Ionic character in covalent compounds: Bond moment and dipole moment. Ionic character from dipole moment and electro negativities.	20h

Sessional Internal Assessment (SIA) Full Marks – 15 Marks
A - Internal written Examination - 10 Marks (1Hr.)
B – Over All Performance including Regularity – 05 Marks

Books Recommended:

- Principles of Inorganic Chemistry, Puri, Sharma and Kalia
- Concise Inorganic Chemistry, J.D. Lee
- Inorganic Chemistry, Moillers
- Text Book of Inorganic Chemistry, P.L. Soni
- Selected Topics in Inorganic, Satyaprakash, Malik, Madan and Tuli, S. Chand Publications
- Advanced Inorganic Chemistry, Gurdeep and Harish

Semester - I

Paper Title: Chemistry Practical – AC -1 LAB

Credits - 01

Full Marks: 25 **Pass Marks: 10**

Content

Titrimetric Analysis :
(A) Preparation of solutions of different Molarity / Normality of titrants.

(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 $K_2Cr_2O_7$ using internal (Diphenylamine, Anthranilic acid) and external indicator.

Experiments - 15 Marks
Viva-Voce - 05 Marks
Notebook - 05 Marks