- To develop energy storage materials and fuel cells.

FIRST SEMESTER

OC H 401: INORGANIC CHEMISTRY

COURSE OUTCOMES:

- Students will learn the basics of ionic and covalent bonding, lattice energy, hydration energy,
- This course enables the students to understand VSEPR theory and MOT theory.
- This course will Enlighten the students to understand Noble gas chemistry, Graphitic compounds, HSAB Concept,
- Theories of redox indicators and sampling techniques.

UNIT- I: **[15 Hours]**

Ionic bond: Properties of ionic substances, coordination number of an ion, structures of crystal lattices- NaCl, CsCl, ZnS and rutile. Lattice energy- Born Lande equation, Born-Haber cycle, Uses of Born-Haber type of calculations. Ionic radii, methods of determining ionic radii, factors affecting ionic radii, radius ratio rule, covalent character in ionic bonds, hydration energy and solubility of ionic solids.

Covalent bond: valence bond theory, resonance, hybridisation, Bent's rules and energetics of hybridization, Deduction of molecular shapes – VSEPR theory.

M.O.theory, application to homo- and hetero-diatomic and -triatomic molecules.

UNIT -II: **[15 Hours]**

Alkali and alkaline earth metal complexes of crown ethers, cryptands and calixarenes and their biological significance.

Halogens and Noble gas chemistry –interhalogens, psuedohalogens, polyhalide ions, oxyhalogen species, xenon oxides and fluorides. Oxy- and peroxy acids of N, P and S. Graphitic compounds, carbides, pure silicon, silica and silicates, zeolites.

HSAB concept. super acids. Reactions in non-aqueous media: Liquid ammonia, anhydrous sulphuric acid, glacial acetic acid, anhydrous HF, bromine trifluoride, liquid sulphur dioxide and dinitrogen tetroxide. Reactions in molten salts.

UNIT- III: **[15 Hours]**

Precipitation phenomena: precipitation from homogeneous solutions, organic precipitants in inorganic analysis. Solvent extraction of metal ions, nature of extractant, distribution law, partition coefficients, types of extractions and applications.

Theories of redox indicators, titration curves, feasibility of redox titrations.

Chelometric titrations- titration curves with EDTA, feasibility of EDTA titrations, indicators for chelometric titrations, selective masking and demasking techniques, industrial applications of masking.

Sampling techniques, preparation of samples for analysis. Nature of errors, statistical treatment of errors, the t- and F-tests, significant figures, rejection of data.

REFERENCES:

1. J.E Huheey, Keiter, Keiter and Medhi: Inorganic Chemistry (4th ed.), Pearson Education, 2006.
2. Shriver, Atkins and Langford : Inorganic Chemistry (3rd edn.) OUP, 1999.
3. J.D. Lee: Concise Inorganic Chemistry, (5th edn.) Blackwell Science, 2000.
4. B.E. Douglas, D. McDaniel & A Alexander: Concepts & Models of Inorganic Chemistry, Wiley 2001
5. W.W. Porterfield: Inorganic chemistry – A Unified Approach, Elsevier, 2005.
6. R.A. Day and A.L. Underwood : Quantitative Analysis, 5th Ed. (Prentice Hall, India), 1998.

OC H 402: ORGANIC CHEMISTRY

COURSE OUTCOME:

- Enable the students to learn the bonding in organic systems, various aspects of aromaticity, electronic effects, acidity and basicity of organic compounds.
- To gain knowledge on methods of determination of reaction mechanism, various reaction intermediates and aliphatic nucleophilic substitution reactions.
- To understand the detailed aspects of optical and geometrical isomerism.

UNIT–I: **[15 Hours]**

Bonding in organic systems: Theories of bonding-Valence and molecular orbital approaches. Resonance, hyper-conjugation and tautomerism, Huckel molecular orbital theory and its application to simple systems- ethylene, allyl, cyclopropyl, butadienyl, cyclopentadienyl, pentadienyl, hexatrienyl, heptatrienyl systems. Calculation of the total energy and M.O. coefficients of the systems. 5 hrs

Aromaticity: Concept of aromaticity, Huckel's rule, Polygon rule, Homo-aromatic, non aromatic and anti-aromatic systems. Aromaticity in benzenoid and non-benzenoid molecules. Annulenes & hetero-annulenes. Physical methods to study aromaticity-UV, IR & ^{1}H NMR. 4 hrs

Bonds weaker than covalent: Addition compounds, crown ether complexes, cryptands, inclusion compounds, catenanes, fluxional molecules. 3 hrs

Structure and reactivity: Effects of hydrogen bonding, resonance, inductive and hyperconjugation on strengths of acids and bases. 3 hrs

UNIT-II: **[15 Hours]**

Methods of Determining Reaction Mechanism: Kinetic and non-kinetic methods, Identification of products, detection of intermediates, isotopic labeling, stereochemical evidences, cross-over experiments, Limitation of reactions, kinetic evidences and kinetic isotopic effects. 5 hrs